130 *Louis B. Hoffmann—For Plaintiff—Cross.*

XQ100. Have you done any developing yourself of the films? A. Not of the actual films, no.

XQ101. Then your technical work has not been in connection with the chemistry of the films or with emulsions or anything of that sort, or with the developing, but has been rather with the taking of the pictures? A. Yes, but more lately with the control work necessary for processing film, that was in connection with my work with the Fox Film Corporation.

By control work necessary for processing film,
131 I mean the methods that are devised for uniformly processing films.

By processing, I mean developing and printing.

I have taken the so-called Movietone pictures or newsreel pictures.

XQ105. During what period have you done that? A. The early pictures that were made in the DeForest Phonofilm Corporation were done that way, in which the sound and pictures were recorded on the one film, the so-called single system.

XQ106. How recently have you done that work?
132 A. As recently as 1928.

XQ107. Even then for these movitones and the newsreels that had the sound and pictures both, they were taken on one negative, on one strip? A. That is correct.

> Mr. Ward: I object, I think Mr. Neave is going beyond the direct testimony. I introduced this witness for the sole purpose of testifying how these solutions compared, and showing the relative merits. He is trying to develop the prior art, prior practice, and I object.

Mr. Neave: This may or may not be prior practice.

The Court: I do not know. If you go beyond the direct, you will make him your witness.

XQ108. In these Movietones, and in the newsreels, where you take the sound and picture on the same negative, you do not split that negative into two, before you develop it, do you? A. No, sir. 134

XQ109. Sound and picture is developed at the same time on the same negative film? A. That is correct.

I have not had anything to do with the preparation of emulsions, and devising developers for these emulsions.

XQ113. Have you ever had anything to do with the developing of separate negatives which would be united on a positive film afterwards? A. Yes, sir. In my connection with the Fox Film Corporation, I started to tell you before, our department had charge of the technical control over the film 135 developing plant, and in that connection at various times, I was the head of the department while my superior was out of town, and in that connection the responsibility for the developing machines, which developed the pictures and the sound separately, came under my supervision. I am absolutely familiar with what are called positive emulsions and negative emulsions.

These tests that I have been speaking of this morning on these photographs, was done quite recently, within the last month.

Negative panchromatic emulsion was used on that film.

136 *Louis B. Hoffmann—For Plaintiff—Cross.*

There was only one emulsion used in my tests. And I applied to that one emulsion, what I call two different developers.

XQ121. Did you know what those two different developers were? Where did you get the formulae for those? A. They were stipulated by the defendant.

XQ122. And you know that the defendant has not used those two developers on the same emulsion? A. I believe that is—I have been told that,
137 yes.

XQ123. That is, to use one developer for the positive emulsion and one developer for the negative? A. Yes. And I used them both for the negative.

XQ125. Referring to your curve, Exhibit 14, which is headed, "Gamma Curve," will you tell me what is shown by that? Don't do it technically, ir you can avoid it. A. It shows the relations—when developed, rather, with a picture negative, it shows the relative weights of the various gradations of exposure on the film. It shows, in
138 other words, the difference between the lightest portion and the darkest portion, the grade of that difference.

XQ126. What does that word "step" mean at the bottom of the chart? A. That is the word that is used in the art to denote the exposure step as used in the device which exposes the strips on the emulsion.

XQ127. Then the exposure is your duration times intensity, is that correct? A. That is correct.

XQ128. Intensity of light. So you plot along on the horizontal line the exposures? A. That is correct.

XQ129. So that this Exhibit 14 means, for instance, that with a certain exposure, say, represented by the numeral 17, you get a greater density on the film if you use the sound developer than if you use the picture developer? A. That is correct.

XQ130. Why do you get that difference, do you know? A. Because of the action of the developing agents that are in the chemical bath.

XQ131. They are the same chemicals, are they not? A. They are of the same kind, but different proportions, different amounts. 140

XQ132. That is, the same chemicals, but different proportions of those same chemicals? A. That is correct.

XQ133. What is it, in that proportion, if you know, that gives you the effect that is shown on your Exhibit 14, when you use both on the same emulsion? A. Why, it is impossible to predict just how much effect the particular proportions that are stipulated by the defendant are going to give. The only way to determine that is empirically, by experiment.

XQ134. They may not give any difference in 141 results if you use them on different emulsions rather than on the same emulsions? A. That is something which no one could predict.

XQ135. Have you ever tried it?

The Court. That is purely speculative, is that it?

The Witness: They would have to be tested by experiment.

XQ136. Have you ever tried the positive developer on a positive film, and the negative de-

veloper on a negative film? A. In this particular case, no sir.

XQ138. How does curve Exhibit 15 differ from Exhibit 14? One has what I call curves on it, the other has straight lines on it. A. In the case of the second curve, the density values, as measured, were converted into opacities, which are the degrees of blackness. The density, of course, the figure density is a logarithmic function—

XQ139. Don't get me mixed up. Can you tell me without doing that, what the difference be-
143 tween density and opacity is? A. I don't believe I can tell you without telling you the fact that the density is the logarithm of the opacity.

XQ140. What did you produce in this curve, Exhibit 15? What does it tell you different from Exhibit 14? A. Why, it does not tell me anything more, being familiar with the art, than the other curve does. It does indicate, though, the extent to which the high lights are given greater emphasis on the one film than on the other.

XQ141. That is with the one developer? A.
144 With the one developer over the other.

XQ142. Well, in both of these cases that you have been producing these charts about, you used the same time of development, did you not? A. That is correct.

XQ143. That means the same duration of the development? A. That is correct.

XQ144. Do you know what is meant by character of development or character of treatment, as distinguished from time? A. I don't believe I do know what you mean by that.

XQ145. Has that not got any regular definition, understood meaning in the art? A. I don't believe so.

XQ146. So if I spoke to you about the character of development or the character of treatment, you would not know what I meant? A. Not as far as the practical art is concerned, no, sir.

XQ147 Well, you may know something about the theoretical art. Would you know what I meant by character of treatment and character of development as distinguished from time? A. No, sir.

XQ148. Did you ever hear of a characteristic curve. A. Certainly.

XQ149. Are these exhibits 14 and 15 characteristic curves? A. They have been called that, yes, sir. 146

XQ150. Is that what you would call a characteristic curve? A. Yes, sir.

XQ151. In looking at Exhibit 14, are those two things you call curves, but which look to me like straight lines, are they not the same except that one is tipped more than the other? A. That is correct.

XQ152. In these two negatives that you produced, both of them using the same photographic material, but one developed with a positive developer and the other with a negative, do you know what the character of the resulting grain structure was in each? A. I have not made a microscopic inspection of it, but by looking at the negatives, it is apparent that there is a fine-grained structure in both of the pictures that were developed. 147

XQ153. That would indicate what? That the developers were the same character? A. Yes.

XQ154. When you were with the Fox Company, you spent most of your time with the newsreel crews? A. No, I did not say that. I did not as

148 *Louis B. Hoffmann—For Plaintiff—Cross.*

a matter of fact, spend most of my time with them.

I said I had some experience with the Fox Film development, that is the development of the pictures. As to the character of that development, as explained, my duties in the research and development division at various times gave me the supervision over the technical work that was being done in the film developing laboratories.

That was development of both negative emulsions and postive emulsions.

149 XQ160. And did you use there the same emulsion, that is the same developer, for the two? A. No, sir.

XQ161. You used a different developer for the positive emulsion than you used for the negative emulsion? A. That is correct.

XQ162. How did they differ? Did they differ like these developers you have been talking of here this morning, having the same ingredients in them, but different proportions? A. Yes, except that in the case of the positive developer, it was quite widely different from the so-called

150 sound developer that we are talking about here. That was from 1930 to 1932, while I was with the Fox Company.

It had a license from the Western Electric Company.

XQ166. In that work with those developers with the Fox Film, can you tell me what the gamma was that you used for the positive? A. In vicinity of the gamma of 2.

XQ167. And for the negative? A. .5 to .6.

XQ168. And the overall? A. It was slightly greater than unity.

XQ169. What do you mean by "slightly"? A.

I have not any exact figures here to indicate what the actual gamma was that was obtained. The only way to give a specific figure is to consider a particular strip of film on which the exposures have been made

XQ170. You said "slightly over unity". A. I mean from .1 to 1.2. (See correction pgs. 127-128.)

XQ171. Was that with a negative emulsion or positive emulsion on the sound record? A. Both. The experimental work, of course, was done with 152 the negative emulsion on the picture and the positive on the sound.

WILLIAM C. BALLARD, JR., called as witness on behalf of the plaintiff, having been duly sworn, testified as follows:

Direct Examination by Mr. Ward:

William C. Ballard, Jr., age 44; residence, Ith- 153 aca, New York; occupation, Professor of Electrical Engineering, Cornell University.

I was graduated in electrical engineering at Cornell in 1910, and was recalled to teach in the School of Electrical Engineering the following year. I have been continuously employed by the University up to the present time. During that time I have been granted a number of leaves of absence to enter into commercial work of one form or another, and in 1917 was granted a leave to act as engineer with the National Electric Signaling Company in Brooklyn, New York. In the latter part of the war I was recalled back to

154 *William C. Ballard, Jr.—For Plaintiff—Direct.*

Cornell to take technical charge of the School for Radio Electricians operated there by the U. S. Army. In 1923 I spent some months with the Westinghouse Electric & Manufacturing Company in the development of certain radio problems, and since that time I have been retained as consultant by the Westinghouse Company, the Atwater Kent Manufacturing Company, the National Carbon Company, the Grigsby-Grunow Company, and the Western Electric Company.

155 In 1926 I entered into a part time agreement with Mr. T. W. Case of Auburn, New York, to devote a considerable portion of my spare time to assisting him in the development of talking movies, which later merged into the Movietone system.

I hold membership in the American Institute of Electrical Engineers, the Institute of Radio Engineers, and one or two honorary fraternities. I have written a book on radio telephony which his been published through several editions and has been translated into one foreign language,

156 and as an occasional contributor to the technical press.

I appeared in a case involving this sound picture art before Judge Adkins in Washington, and another one before Judge Nields in Wilmington, Delaware, as an expert witness.

I was retained in another case heard before Judge Morris in the Delaware court, by the Western Electric Company.

All those suits were in connection with sound pictures.

Q6. Are you familiar or have you read and do you understand the statements of defendant's process as set forth in Exhibit 12 and the ac-

companying strips of film, Exhibit 12-A? A. Yes.

Q7. I show you a chart that is now on the easel, and I will ask you if in your opinion that chart, based on those statements, correctly represents the defendant's process, and if not, point out in what ways or details it does not? A. This chart does represent the defendant's process, as I understand it.

Q8. With the understanding that it is only diagrammatic? A. Diagrammatic, schematic.

Q9. It correctly represents it, as you understand it, to the extent of the details it goes into? 158
A. Yes, sir.

Mr. Ward: I offer in evidence, the chart last shown the witness.

(Marked Plaintiff's Exhibit 22 in evidence.)

Q10. I show you a diagrammatic chart which is now on the easel, and will ask you if you are familiar with that chart? A. I am.

Q11. Will you please state whether or not that 159
chart, to the extent that it shows the details, is a correct illustration of defendant's process, as you understand it from that statement tha I referred you to? A. It is.

Mr. Ward: I offer the second chart in evidence.

(Marked Plaintiff's Exhibit 23 in evidence.)

Q12. Professor, will you look over the caption or printing on that chart, Exhibit 22, and state

160 *William C. Ballard, Jr.—For Plaintiff—Direct.*

whether, in your opinion, they are correct as indicating defendant's process to the extent to which they do indicate it as you understand from those statements in Exhibit 12? A. They are substantially correct.

Q13. Are you familiar with the patent in suit? A. I am.

Q14. And have you read the original German and the translation of the German application, Serial No. V16431 V157a2 upon which the United
161 States application for the patent in suit was based as to priority? A. I have.

Mr. Ward: It is stipulated between counsel that the applicants in the case of the German application on which priority of the patent in suit is based are the same as the applicants in the U. S. application on which the patent in suit was issued, and that the same parties are applicants on the application on which French patent No. 532,750 was issued.

162 Mr. Neave: I agree to that.

Mr. Ward: If it was issued.

Q15. Professor, will you please take the patent in suit and explain it to the Court? A. The patent in suit refers to the production of speaking films in a manner in which the sound record and the picture record are so recorded as to make it possible for separate development and appropriate treatment should it be desired.

Referring to the chart, Exhibit 22, the picture record is impressed on one strip of negative film producing the latent image which is developed in an appropriate manner, and the photographic

sound record is recorded on another strip of film which may or may not be united during this process, and then passes through an appropriate developing process. Later these two strips of film are printed upon a single positive strip, which is later developed to produce the final product for reproduction in the usual type of talking picture reproducer.

Q16. Now will you go right through the specification from that point? A. Reading from the specification: "This invention relates to processes 164
for producing combined sound and motion picture films.

"In the production of speaking films it is of great advantage especially from the point of view of use, to arrange the sound sequence and the picture sequence upon one and the same piece of material (film).

"In this procedure, however, there frequently occur in consequence of the changing lighting conditions in the cinematographing process, changes in the degree of exposure of the silver bromide coating, and this causes the picture se- 165
quence to be either over exposed or under exposed.

"As the same film, however, carries close to the picture sequence the normally exposed sound sequence, these difficulties resulting from differences in exposure cannot be remedied in the case of combined negatives, by developing practices such as by weakening, strengthening, and so forth. They can only be remedied by subjecting the under exposed or the over exposed portions of the negative to separate appropriate treatments."

Q17. Will you explain to the Court there what the patentee is referring to by the under exposed

166 *William C. Ballard, Jr.—For Plaintiff—Direct.*

and over exposed portion of the negative? A. The under exposed or over exposed portion of the negative refers in this case to the portion of the negative devoted to the picture representation.

Q18. What is the system that the patentee is pointing to there, and which they are criticizing? A. That is the system in which the sound and picture images are made upon a single strip of sensitized film and developed simultaneously in the same bath without being subject to separa-
167 tion.

Q19. Such, for example, as the system diagrammatically shown on the chart which I show you? A. Yes.

The Court: In other words, to make possible the different development, they wanted to make them on different strips? That is what it means in substance, isn't it?

A. Yes.

Mr. Ward: I offer in evidence a photo-
168 static copy of the chart last shown the witness.

(Marked Plaintiff's Exhibit 24 in evidence.)

Q20. Now will you proceed, Professor? A. Continuing at line 31: "According to the present invention the difficulty is overcome by either employing entirely separate films," that is separate films are indicated on the chart at appropriate points, "for the simultaneous photographing of the sound and picture negatives, or films which are connected during the photographing, but

which are separated from one another before the developing, then separately developing the negatives if and in the manner required to remedy the difficulties, and then printing both sequences —picture and sound—on the different portions of the same positive film." I think this is evident from the chart.

"The synchronism is assured in both cases by the perforations and/or by corresponding marks."

The perforations are visible on the chart, and 170
the corresponding marks can be used to indicate the start of each of these corresponding two recordings.

"The production of the combined positive film can take place by copying the two negative films —sound and picture—preferably consecutively upon the same positive film." Then reference is made to the three figures in the drawings.

Fig. 1 shows the sound and picture recorded on two entirely separate films. Fig. 2 is a positive record made either from the representation of Fig. 1, or perhaps from Fig. 3. Fig. 3 shows a modified form of film in which the two records 171
are made upon the same strip of film and separated before development.

Q22. That is, Figs. 1 and 3 show the two forms of negatives that the patent discusses, and Fig. 2 shows a form of positive where they are printed on one film? A. That is true, and that can be checked by the representation of the picture record. It will be noted that in Fig. 1 and Fig. 3 the picture record is white in the lower right hand corner, which, of course, when printed, would give a black positive record, as indicated in Fig. 2.

"If for the record two separate films with

standard perforations are used two negatives are produced as shown in Fig. 1." This is also the case according to the representation on the chart. "The sound-record comprises the row of tones t, the picture record comprises the row of pictures b. The tone row is preferably arranged near one edge of the film. The two negatives are then copied on a single film, as shown in Fig. 2. If for the two records a common film is used, this has preferably the form shown in Fig. 3. This film comprises between two rows of perforations the
173 picture record b and the sound record t. Before the developing, the film is separated at p or at u." That refers to Fig. 3.

Q23. That is before the negatives are developed? A. That is before the negatives are developed. "If the sounds have to be recorded at the side of the picture record, outside one row of perforation, a film strip like the one shown in Fig. 2 is produced on which the picture record is between two rows of perforations whilst the sound record is arranged at one edge of the film strip,
174 outside the corresponding row of perforations."

Then an alternative way of printing is suggested. "One can, however, previous to the printing, unite longitudinally together the two developed negative films, and then copy this so united negative in the usual manner." This method is not indicated on the chart.

"Other benefits may also be derived from the broader aspects of the invention, i. e., from employing separate or separable film areas for the recording of the sound and picture negatives, and then printing both the sound and picture sequences on different portions of the same positive film.

"In the following claims where reference is made to a 'length of film' upon which a sound record is recorded, such 'length of film' shall be interpreted as referring to a strip of film which may be either entirely separate from or merely separable from the film strip carrying the picture sequence.

"While the invention has been described in detail with respect to certain particular preferred examples thereof which give satisfactory results, it will be understood by those skilled in the art 176 after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims, to cover all such changes and modifications."

Q24. Now will you refer to the translation of the German application and to a copy of the United States patent application as filed, and state whether you find any substantial or material differences in the two documents? A. I find no such substantial or material differences between these two documents. 177

Q25. Will you please take either one of these specifications, suppose you take the German, being the earliest, and explain that to the Court? A. Shall I read this through, pointing out the similarities in the same manner as the United States patent?

Q26. Yes, please. A. I am now reading from the translation of the German application as filed. "In the production of talking films it is of great advantage, particularly for operating reasons, to fix the sound series and the picture series upon one common material carrier (film)." That

178 *William C. Ballard, Jr.—For Plaintiff—Direct.*

is illustrated at the lower edge of this chart. (Exhibit No. 22.) "In this process, however, in consequence of varying lighting conditions in connection with cinematographic picture recording, differences frequently occur in the degree of illumination of the silver bromide layer with the result that the picture series is overexposed or underexposed. But, since the same film also carries the always normally illuminated sound series close to the picture-series, these differences,
179 in combined negatives, cannot be compensated for by developing, toning down, intensifying, etc.

In other words, if the negative record is made as indicated by the sketch near the bottom end of the chart, it is impossible or extremely difficult to develop one series without developing the other one at the same time.

"They can only be eliminated if the underexposed and overexposed portions of the negative are subjected to a separate, suitably adapted treatment.

Technically this is practically impossible as
180 long as the two series of events are on the same film."

I think this last statement is obvious.

"According to this invention this difficulty is obviated in that for the production of the negatives, either entirely separate films are provided or those which although still united during the recording are, however, detached from each other before the developing. Synchronism in both cases is insured by the perforations and by corresponding marks. The production of the positive film"—

Q27. Will you point out just what that means, "Synchronism in both cases"? A. Synchronism in both cases, referring to the two suggested pro-

cedures, one of which involves two entirely separate films and the other of which involves a film which is originally joined but later separated after exposure—synchronism is insured by the perforations of the two separate films in that they are driven through the two cameras at the same speed and corresponding marks would refer to marks made on the film indicating the starting point of the exposure on both sound and picture films.

The next paragraph refers to the printing of 182
these two films upon a single positive film:

"The production of the positive films can be accomplished by having the two negative films, preferably one after the other, copied onto the same positive film. However, the two negatives can be previously pasted together in the lengthwise direction and the combined negative thus obtained copied in the usual manner."

Q28. When the films, the negatives are thus copied, what will be the relation of the picture and sound on the composite positive? A. They will occupy different lengthwise-extending portions of the positive film near one another. 183

Q29. Referring to the old method, the one which the present case refers to in the specification, have you any prior art patents or prior filed applications which illustrate that system? A. There are a number of patent applications illustrating the method of recording sound and picture on the same film strip simultaneously. Perhaps the earliest is disclosed in the British patent to Haines, No. 18,057, of 1906.

The Witness: French patent to Canton, No. 459,537; United States patent to Ries, No. 1,473,976—

184 *William C. Ballard, Jr.—For Plaintiff—Direct.*

Mr. Ward: I offer copy of the United States patent to Ries, No. 1,473,976, referred to by the witness.

(Marked Plaintiff's Exhibit 25 in evidence.)

The Witness: Also French patent No. 448,757 to MacCarty of 1912.

Mr. Ward: I offer in evidence photostatic copy and translation of said MacCarty patent.

185 (Marked Plaintiff's Exhibit 26 in evidence.)

The Witness: There are others. Also United States Patent, No. 1,186,717 to Walker. Also British patent No. 157,433, of 1922 to Vogt.

Mr. Ward: I offer the last-mentioned patent in evidence as Plaintiff's Exhibit 27.

(Marked Plaintiff's Exhibit 27 in evidence.)

Q33. Now, will you point out to the Court the 186 similarity in the patentee's method or process and that of the defendant, using this chart for illustration, this chart, Exhibit 22? A. The patentee proposes to employ two entirely separate films, according to the specification, beginning line 31. These two films are represented on the chart and are labeled "Exposed Motion Picture negative Film" and "Exposed Sound Negative Film."

The patentee describes the desirable condition of developing these two films separately according to the requirements of each which is assumed to be done by the step indicated as the developing machines respectively for sound and picture stock.

The production of the combined positive film can take place by copying the two negative films. This step is indicated in the rectangle, although no details are shown, it being well-known in the art how to accomplish this, and producing the combined sound and picture positive film which is later developed and finished, these two records being printed upon the same strip of positive film.

Q34. Now, what have you to say with respect to the separate developments of the sound and picture of the defendants, being in a manner ap- 188
propriate or suitable for each, having reference to the defendant's statement Exhibit 12 and film Exhibit 12-a, for such information as you wish to give on the subject?

The Court: Before you refer to the chart, that is exhibit number what?

Mr. Ward: 22.

A. I find in paragraph 8, the statement made, paragraph 8 of the second section of Exhibit 12, the statement made that "The overall gamma of 189
the picture record is substantially 1.2 and the overall gamma of the sound record is substantially 1.0."

The overall gamma of any combined positive and negative process is found by multiplying the gamma of the positive and the gamma of the negative process together. So that if the overall gamma of the picture is substantially 1.2 and the overall gamma of the sound record is substantially 1.0, and from the obvious condition that the gamma of the positive record must be the same because they are printed upon the same stock and

190 *William C. Ballard, Jr.—For Plaintiff—Direct.*

developed in the same bath for the same length of time, we can see that there must be at least a 20 per cent. difference in the negative gamma of the sound film and that of the motion picture film. Two quantities multiplied by the same quantity producing products that are different by 20 per cent. must originally differ by 20 per cent. themselves.

Q35. Now, according to the statement of the defendant, which you have been referred to, what
191 do you find the relative time of the action of the developer on the film to be, that is, with respect to the sound negative and picture negative? A. Paragraph 7 states that: "The time of development of the picture negative is between 9 and 12 minutes, and the time of development of the sound negative is between 4 and 5 minutes."

Q36. What is the temperature in each case? A. The temperature in each case is maintained at 65 degrees Fahrenheit, and this applies to both sound and picture developing.

Q37. Do you also find from the statement that the defendant's sound negative is made on so-
192 called positive stock? A. That is so.

Q38. Whereas the defendant's picture negative is made on so-called negative stock? A. Right.

Q39. Can you state which of those stocks were developed—or state what would be the action of, say, a given developer, on those two stocks? A. Not having the exact charactertistics of those stocks given, it is difficult to answer that question, but in general the developer for negative stock and the developer for so-called sound positive stock is quite different, and the same developer would, in all probability, have different effects upon these two stocks. That is the general propo-

sition, with respect to positive and negative stocks, developed, say, in the same developer.

Q42. If you used the same developer that the defendant uses for "picture negative stock," and utilized the same time and temperature, and put the positive stock, carrying the sound record through there, along with their picture negative, can you state in a general way what the result would be? A. Since the positive stock in general develops more rapidly, it would probably result in a sound track that would be too dense, if the 194
time and developer were the same in either case.

Q43. In your opinion, from what you know of the defendant's process, by these statements and the data that you have referred to, would you say that their picture and sound negatives are separately developed in a manner appropriate for each or in a manner not appropriate for each? A. I would say that they are separately developed in a manner appropriate for each.

Q44. Can you state in a general way to what extent this method of the patent in suit described in the chart here, chart No. 22, has gone into commercial use, do you know? A. It is my under- 195
standing that nearly all of the large companies employ this method of recording on separate films and printing together on a single positive in at least a part of their production; that its use is very widespread.

Q45. What about the separate development of the two films? A. Which would include the separate development of these two films.

Q46. Have you seen the plaintiff's Exhibits 13, 14, 15 and 16 introduced through the witness Hoffmann (handing to witness)? A. I have.

Q47. Will you please take Exhibit 19, and point

196 *William C. Ballard, Jr.—For Plaintiff—Direct.*

out to the Court, what, if any, differences you observe in those two pictures on that exhibit? A. I note that the dark portions of these two pictures have nowheres the difference in density that the lighter portions have and that there is a marked difference in the degree of distinctness with which the characteristic weave of the girl's sweater can be seen in these two pictures, this being perhaps the lightest portion of the two pictures. The upper picture has less contrast than
197 the lower picture, and would be defined as being a softer picture, while the lower picture is characterized as a harsher picture.

Q48. Which of the two is the better picture, from the standpoint of motion picture practice? A. I would rather hesitate to say because there are various demands in projection which might make one the better and might make the other the better. It depends on the final result that you desire to obtain.

Q49. Explain what you mean. A. In general, for motion picture projection, it is desirable to
198 have a positive film of considerably higher contrast than that which actually existed in the object photographed in order to produce the requisite brillancy on the screen.

Q50. Now, will you refer to the curves on the other two exhibits you have, which are 14 and 15, and state whether those curves are in general in accordance with the results on those pictures? A. They are.

Q51. From the results on those curves and the results on the pictures, would you say that the defendant's picture developer and the defendant's sound developer are the same or different? A. They are different.

Q52. Mr. Neave, in his opening remarks, made some reference to the large number of lines that were photographed on the sound record, using defendant's so-called light valve recording apparatus as contrasted to the plaintiff's glow lamp for the purpose of recording. Can you state whether or not there is any characteristic difference in the number of light lines that would be recorded in a given time by one of those methods or the other? A. Either system is probably accurate enough to record most of the frequencies encountered in normal sound. There is a somewhat well-defined upper limit beyond which the Western Electric system refuses to operate, whereas no such well-defined limit exists in the case of the glow light. The upper limit of the Western Electric system is a sufficiently beyond the usable range so that it makes little difference.

Q53. For what value it may have, you do not agree with him then that the light valve system records any more of these lines per unit of time than the glow lamp system? A. No; quite the contrary, as far as ultimate possibility is concerned; the range is higher with the glow light 201
than it is with the Western Electric light valve.

Q54. Will you refer again to the specification of the patent in suit, if you haven't already covered this point, Professor, and explain to the Court briefly what is meant there at line- 16 to 18 with regard to the normally exposed sound sequence, having reference to the light for recording? A. In the Western Electric light valve system an incandescent lamp is normally the source of light for sound recording, and this incandescent lamp is maintained at a constant brillancy, this giving what might be called a nor-

202 *William C. Ballard, Jr.—For Plaintiff—Direct.*

mal exposure except when the light valve is in operation. And the same thing is true in general terms when the glow light is used, the current passing through the glow light does not vary except when sound is to be recorded.

Q55. That is, in both cases the amount of light passing through from the lamp to the sensitized surface is substantially steady, and it is fluctuated on each side of a horizontal line responsive to the sound vibrations? A. That is correct.

203 Q56. Are you familiar with the patent of Lee DeForest No. 1,489,314, which was involved in the interference that I referred to in my opening this morning? A. Yes.

Q57. Will you state briefly what is the object of the invention set forth in that specification, and in connection with it point out whether there is any reference to separate development as an object of the invention? A. This patent discloses a method by which a sound record may be transferred onto the edge of a positive picture record by optical means, being reduced in extent at the

204 same time. There is no mention in this patent of separate development or of the advantages of separate development.

Q58. Does this patent say anything with regard to any theory of over-exposure or under-exposure of the picture with respect to the sound? A. I see no such statement.

Q59. Do you find any other object suggested or set forth in the patent other than that of being able to get an enlarged sound track, and then rephotograph that onto the film with the picture record, or of being able to split the sound record and put part of it on one side of the picture and part on the other side? A. This seems to be the principal object to be attained in this patent.

Cross Examination by Mr. Neave:

XQ60. A few minutes ago Mr. Ward asked you about the extent of use of what he said was the process of the patent in suit, and that is to photograph the sound on a different negative than that on which the pictures are photographed, and you made some answer as to your understanding. What do you know actually of the extent of the use of that process? A. Only by hearsay evidence.

XQ61. By the same evidence you know of many 206
instances on which they photograph on the same negative both the sound and the picture? A. I have heard that that is being done at the present time; not to the extent that the other system is being used.

XQ62. But your knowledge, you have no knowledge on either piont, have you? A. Well, I have never been employed by these concerns to learn their processes.

XQ63. Then, Mr. Ward, after asking you those questions, asked whether that included separate development of these two films, and you said that, 207
it necessarily did? A. If you will define what you mean by "that."

XQ64. What did you mean by saying whatever you had said before? I do not know what it was involved the separate development of the films. May I ask you this: Do you understand that these people who have these two negatives, simultaneous negatives, one for the sound and one for the picture, do all of them develop separately? A. I understand that they do.

XQ65. And that is necessarily true because they have separate negatives, isn't it? A. Not

necessarily true, no, sir. Under some special conditions they might be run through the same bath and joined together. That might be done; I have no knowledge that it is done.

XQ66. You also spoke of the use of the glow lamp and the light valve. Do you understand the glow lamp is ever used nowadays? A. I understand it is, but not always.

XQ68. Do you know that the Western Electric light valve does not use a glow lamp? A.
209 I do.

XQ69. Don't you know that it is the principal thing used today, don't you know that? A. I wouldn't say that, because I do not know to what extent the Western Electric system and the R. C. A. Photophone system are in use today. The Western Electric system employs a light valve, and the R. C. A. Photophone system does not employ a light valve.

XQ70. Do they employ the glow lamp? A. No, they have a galvanometer movement, they do not use the glow lamp. I understand there is
210 some work going on on the glow lamp among independent manufacturers on the west coast today, not experimental work, regular photographs. I know at one time most of the Fox movietone newsreels were made by the glow lamp.

XQ75. You know they abandoned the glow lamp and took up the Western Electric light valve? A. Not for news pictures; I have no such knowledge.

XQ76. You know that they are using the light valve, don't you? A. They are using the light valve for studio work, I understand.

XQ77. And you know they are using the light valve for their modern pictures? A. For their studio pictures, I understand that is the case.

XQ78. You didn't mean to say a moment ago that a normal exposure was not attained with the Western Electric light valve, did you? You get a perfectly normal exposure with that, don't you? A. I do not remember having said that, Mr. Neave.

XQ79. However, you do get a normal exposure, don't you, with the Western Electric 212
light valve? A. Well, the exposure can be adjusted over quite a wide range, by adjusting the intensity of the light. And there should be no difficulty in getting a normal exposure if you so desire.

XQ80. And the glow tube is an under-exposure, isn't it? A. Not at all times.

XQ81. It does wobble down into the under-exposure range, doesn't it? A. You will have to define "under-exposure," Mr. Neave.

XQ82. Then I will have to get technical. It works on the toe end of the curve? A. Yes, 213
the toe is quite satisfactory in many cases.

XQ83. That gives you wrong values, and then you do something afterwards to compensate for the wrong values? A. Oh, no, not at all.

XQ84. If you work on the toe of the curve, unless you take certain precautions, you get an erroneous value, don't you? A. That is merely a question of percentage of erroneous value; it might be slightly higher under different conditions, but by a proper selecting of the point on the curve it might be quite close to correct conditions.

214 *William C. Ballard, Jr.—For Plaintiff—Cross.*

XQ85. You were testifying from the chart, Plaintiff's Exhibit 22, and on that chart it is noted that the sound negative film as shown is positive stock, and the picture negative film as shown is negative stock. What is the difference between positive stock and negative stock? A. The difference in the—I can tell you only by results. The negative stock in general gives greater grainness, less resolution, and the positive stock more resolution. Resolution is tied
215 up very intimately with the size of grains of silver material.

XQ86. Suppose you have large grains, then you have large resolution? A. No; small grains give you large resolution.

XQ87. What do you mean by "resolution"? A. Resolution is in general reciprocally related to the size of grain, silver grain.

XQ88. What is it that is related? Is it the smell of the thing or the color? A. The value of the resolution.

XQ89. What is "resolution"? A. Resolution
216 is a quality which is concerned with the size of the reduced silver grain on the photographic image.

XQ90. If you get a reduced silver grain you get better resolution? A. The smaller size the silver grains, the better the resolution.

XQ91. Having better resolution you have better what? A. With smaller grains you get a better definition.

XQ92. You mean you get a narrower line, a sharper, narrower line of striation, is that what you mean? What do you mean by "resolution"? A. I do not think the size of the grain,

once they are down to normal size, makes very much difference, as far as that is concerned. The difference is in the character of sound that is produced, because you have less extraneous background noise produced with the high resolution sound emulsion.

XQ93. But when you have a smaller grain you say you have higher resolution. Having a smaller grain, what is the advantage? A. Less background, less extraneous noise.

XQ94. Less background noise? A. Yes, for one thing. 218

XQ95. Is that all you mean by "resolution"? A. I think as far as it applies to sound records, that covers the situation pretty well.

XQ96. Then the resolution has nothing to do with frequencies, has it? A. I think on the film used today it has very little to do with frequencies.

XQ97. What do you mean by that? A. Well, that the size of the grain, either the coarse grain stock or fine grain stock, is so much smaller than the narrowest line that is reproducing the sound, that the dimensions are not comparable with one another at all. 219

XQ98. Why is it if you know that the defendant uses a positive stock for its sound film and a negative stock for its negative film? A. The question is why is it that I know?

XQ99. Yes. A. Because it is so stipulated.

XQ100. Do you know why they do this? A. It is because it is so stipulated.

XQ101. Do you know why they use a positive stock for the negative sound film? A. No, I do not know why they do it.

220 *William C. Ballard, Jr.—For Plaintiff—Cross.*

XQ102. You do not know why they use a negative stock for the negative picture film? A. I can surmise that it is due to the fact that the negative stock, having more rapid photographic action, is a better suited structure for pictures.

XQ103. Why? Isn't the recorded sound just as rapid as the recorded picture? A. It does not require the degree of light.

XQ104. It does not require the degree of light? A. The sound does not.

221 XQ105. You do not have as much light on the sound record as the picture record? A. The amount of light on the sound record may be adjusted within very wide limits by adjusting the brilliancy of the lamp, and it is an easy job to adjust the light with the Western Electric light valve for using the positive stock, and you get a less time for development of the stock, while that would be somewhat difficult in the case of picture records.

XQ106. Why wouldn't the defendant be just as happy if he would use negative stock for both
222 the sound film and for the picture film? A. I cannot answer that question.

XQ107. Do you know what the relative scope of the positive and negative stock is? A. I have nothing special on that.

XQ108. Then how can you tell what the action would be in different developers on the positive and negative stock? A. I am assuming the positive stock requires, and defendant has so stated, that with two developers having somewhat similar characteristics, but still they do differ in that the difference in time required is better than a ratio of 2 to 1.

XQ109. And therefore what? A. I am assuming that the positive stock then takes a shorter period of development time than the negative stock.

XQ110. But they are using different developers? A. No, with the same developer.

XQ111. They do use different developers on the positive and negative stock, do they not? A. That is true.

XQ112. And they use different times for the different developers? A. That is true.

XQ113. What is gamma? You were talking 224
about gamma a few moments ago; what is gamma? A. Do you want me to go through a technical explanation of it?

XQ114. No; I want to know what your answer meant. Mr. Ward asked you a question, and you said according to the stipulation the gamma was of such-and-such a value in one case, and such-and-such a value in the other case, which seemed to me to have no reference to the question asked. Now, gammas may mean something, or else you could get no such in- 225
formation from them. What did you mean by referring to gammas? A. If the log of exposure is plotted against the consequent density, the slope of the curve plotted is the gamma of the operation.

XQ115. What has that slope of the curve got to do with anything Mr. Ward asked you when you referred to the stipulation, Exhibit 12-A, talking about gamma? A. The effect of a high gamma is to produce an abnormal contrast, and a low gamma is to produce sub-normal contrast.

XQ116. Has that got anything to do with

these developers you were talking about? A. I think in general it has, yes.

XQ117. In what connection was it? A. I haven't the record here. In what connection was it you did refer to 12-A and talk about the gamma, what was the question that was asked you, do you remember? A. You will have to refer to the record.

XQ118. You pointed out that the over-all gamma was different for the two negative films. What difference does it make if the over-all
227 gamma is different? A. It indicates that the two negative films are developed to a different degree of contrast.

XQ119. So that they were different emulsions to start with? A. Well, that makes no difference if they were different emulsions. Gamma is the combined effect of the developer and the emulsion.

XQ120. Now, you refer to the patent in suit at line 18, and you will find the words "these difficulties." What do you understand those difficulties to be that are referred to there? A.
228 I do not follow you.

XQ121. Line 18. A. The under or over exposure of the picture sequence.

XQ122. Well, now, line 18 proceeds to say: "these difficulties resulting from differences in exposure," so the difficulties aren't the differences in exposure, are they? A. Yes.

XQ123. The difficulties are the differences in exposure? A. The differences in exposure of the picture sequence.

XQ124. Are the difficulties? A. I do not exactly get your question.

XQ125. I understood you to say that the difficulties were differences in exposure. A. Yes.

XQ126. There isn't any difficulty in getting a difference in exposure, is there? A. I do not think that we define the word "difference" in that case. "Difference" may relate to the fact that the picture record is over-exposed with respect to the sound record, or it may be under-exposed with reference to the sound record. The under-exposure and the over-exposure, I take it, are comparative terms, and there must be some normal point from which to work. 230

XQ127. "These difficulties resulting from differences in exposure"—let me ask you again what the difficulties are? A. Due to the under-exposure or over-exposure of the picture sequence.

XQ128. What is the difficulty that is produced by the under-exposure or over-exposure? A. The necessity for separate development in order—

XQ129. Separate development of what? A. Of the correctly exposed portion and the incorrectly exposed portion. 231

XQ130. The correctly exposed portion is the sound, and the incorrectly exposed portion is the picture film? A. I think that is a fair statement.

XQ131. Look at line 31, it is line 32, I think: "The difficulty is overcome," the word "difficulty" is used again. What is that difficulty in line 32? A. The difficulty of producing an acceptable positive film by the old former method.

XQ132. Former method was taking both the

232 *William C. Ballard, Jr.—For Plaintiff—Cross.*

sound and the picture on the same negative? A. On the same negative.

XQ133. This difficulty is overcome how, the difficulty at line 33, it is overcome by the separate development of the two films, isn't it; is that right? A. I think so.

XQ134. Then let us look down a little further, at line 39: "Then separately developing the negative if * * * required to remedy the difficulties." According to the specification up to that point the difficulties are remedied only
233 by separate development, aren't they? A. If and when required.

XQ135. No, up to that point, the difficulties are remedied only by separate development? A. If such difficulties exist, yes.

XQ136. Up to line 39, the difficulties were necessary, weren't they, according to the statement? Look at line 18, you will see these difficulties resulting from different exposure cannot be remedied in the case of combined negatives by development together and so forth, and then line 27, "Technically, this treatment is
234 practically impossible so long as the two sequences—picture and sound—are photographed upon the same film strip." So the specifications there say, do they not, that you must get two negatives on two different strips so that they may be separately developed, and that is the only way of remedying the difficulty, isn't that true? A. According to the description of this patent, yes.

XQ137. But when you got to line 40 which says: "Then separately developing the negative if * * * required to remedy the difficul-

ties"? That is the first intimation there, isn't it, that it isn't absolutely essential in all cases to separately develop in order to remedy the difficulties? A. I think there might be a hypothetical condition where due to some special emulsion or some special treatment, this separarate development might be dispensed with, I do not know of any practical condition like that.

XQ138. Let us assume that is true, let us get back to my question. This is the first point in the specification that there is any intimation of anything of that sort? A. Yes, I think that 236
is a fair statement.

XQ139. You find no such intimation in the German application, do you? A. Those words were inserted, I think, later—I beg your pardon, I understand—

XQ140. Beg pardon? A. I understand that does not appear in the German application. I do not see those words.

XQ141. I want you not only to explain whether those words are in the German application but whether there is anything in the German application that even intimates that? A. I should 237
think it would be quite obvious to one in the art if special conditions would not require a separate development, then you would develop it in the same developer at the same time.

XQ142. Does the German specification say that the only way to cure the difficulty is to have a separate development? A. Yes, but if you do not have the difficulties why try to cure them by separate development.

XQ143. Is this patent treating with these special conditions? A. The patent is dealing with the way to overcome difficulties.

238 *William C. Ballard, Jr.—For Plaintiff—Cross.*

XQ144. And the only way to overcome these difficulties is by having a separate development, that is the disclosure in the German application, is it not? A. Yes.

XQ145. Look at the patent in suit and look at line 83. That line begins with the words "Other benefits". Up to that point what had been the benefits derived from the invention as set forth? A. Production of an accurate positive with regard to sound and picture.

XQ146. Go on, at line 83, read that whole
239 paragraph beginning there and tell me what the other benefits are that were referred to in this paragraph. A. What other benefit may be derived, is that the question?

XQ147. Yes, what other benefits that are referred to there in that paragraph? It says, "other benefits may also be derived." What are those other benefits? A. May use different quality of recording stock, may be able to take several picture records simultaneously of a single action, several sound records of a single action.

240 XQ148. Do you find anything in the German application corresponding to the paragraph beginning on line 83 of the patent? A. Other benefits? I do not find that in the German application.

XQ149. Now, as I understand it, you have testified in answer to questions by Mr. Ward, with reference to certain British and French patents that at the time that these Vogt and others, made their alleged invention, there was nothing new in having the sound record and the picture record on the same film, that is true? A. On the same positive film.

XQ150. And there was nothing new in having the sound record with picture record on the same negative film, was there? A. That is true.

XQ151. And there was nothing new in photographing the sound record and the picture record simultaneously on the same negative film? A. That is true.

XQ152. And there was nothing new in transferring those negatives to a positive film, was there? A. No.

XQ153. And there was nothing new at the time when these patentees made their alleged in- 242
vention to photograph simultaneously the sound record on one film and the picture record on another film? A. It was proposed in the art, yes.

XQ154. But there was nothing new in separately developing those separate negatives, was there? A. No.

XQ155. And there was nothing new in thereafter uniting them on one positive film, was there? A. I find no reference about uniting these two records on a single positive film in the prior art. 243

XQ156. You find a lot of prior art where there were two negatives that were combined on one positive? A. Not two separate negatives combined on one positive.

XQ157. I am sure you must. Craig did that, did he not? A. Not in the manner shown on the chart, I will state that—

XQ158. I am not talking about details. Craig did have a negative for the sound, and a separate negative for the picture? A. Yes, that is right.

XQ159. And he put them both on the same positive film? A. I don't know whether he ever did.

XQ160. He described it. A. Yes, he would like to do it.

XQ161. So that there was nothing new in that at the time when Vogt came along? A. I can not say that, because I don't think it ever had been done.

XQ162. There was nothing new in the knowledge of having that done? A. In the knowledge
245 of putting it on opposite sides of the film, the desirability.

XQ163. Putting them on the same positive film, because Craig had done it on opposite sides, but they were on the same film, were they not? A. Yes, I think that is a fair statement but not on the same side or side by side.

XQ164. Then tell me what you think is disclosed in this patent in suit that is new? A. I find no reference whatsoever in the prior art to any system which employs two separate negatives, sound and picture records, develops sepa-
246 rately, and prints them in the usual manner on a single positive film.

XQ165. What do you mean by "usual manner"? A. The manner described by the inventors and the manner in use, in general use at that time.

XQ166. The inventors describes two manners, one printing them consecutively and one printing them simultaneously, do they not? A. With the same final result, of course.

XQ167. Then what is new that you do not find in the prior art, that you think is new here,

is printing both the separately exposed, separately developed negatives side by side on the same side of the positive film, is that what you mean? A. I think that is a fair statement.

XQ168. Of course, you know that it was old and well-known to have both the picture sequence and the sound sequence printed side by side on a positive film, you know that, do you not? A. Yes.

XQ169. You are familiar with the Bullis patent that was cited in the file wrapper of these 248
cases, the Bullis prior patent? A. Which patent is that?

XQ171. Bullis, No. 1,335,651. A. Yes, I have got it.

XQ172. There the sound was photographed on one negative and the pictures were photographed on a separate negative? A. Yes.

XQ173. And then those separate negatives were separately developed? A. Yes.

XQ174. And then they were brought together into one positive? A. No, I find no reference to that in the Bullis patent. I find nothing but a 249
complete separate treatment throughout with two separate positives produced.

XQ175. Two strips of positive were brought together to form one film? A. I should not think that two films of positive glued together would constitute a single film.

XQ176. And you would say it was old to put the sound record beside the picture record on a single film, was it not? A. Yes.

Cross Examination (Continued) by Mr. Neaves

The Witness: In reading the last question and the next to the last question, in which Mr.

Neave was questioning me in regard to the Bullis patent, I find that at XQ175, he asked me: "Two strips of positive were brought together to form one film", referring to the Bullis disclosure, as I understood it, and I answered, "I should not think that two films of positive glued together would constitute a single film." Then he further questioned me: "Then you would say it was old to put the sound record beside the picture record on a single film, was it not?" I then did not understand that Mr. Neave was continuing his questions in regard to the Bullis patent. If I had I would have, of course, answered that "No", because I think it is quite evident from the previous question, and it was answered "Yes," only with the understanding that it referred back to the old time system of recording a positive and negative on a single film.

By Mr. Neave:

XQ177. That was my understanding, Mr. Ballard, and that "then" in XQ176 should have been "and," and was not intentional, and I have changed it in my copy. That last question was not a continuation of the Bullis discussion, but it was old, was it not, to have the sound, that is, old prior to the alleged invention of these patentees here, to have the sound record beside the picture record on a single film? A. In the form of a positive or in the form of a negative?

XQ178. In the form of a positive? A. Yes, that is disclosed in the prior art in connection

with the single film system, in which the positive and negative records are both made on a single film.

XQ179. But my point was that it was old to have a positive which held both the sound record and the picture record, and the two were longitudinally aligned on the same positive film? A. Yes, it was old but it was not disclosed by Bullis.

XQ180. Bullis recorded in synchronism, didn't he? That is, the sound and the pictures were 254 recorded synchronously with each other?

XQ181. Do you remember the Walker patent that you referred to? A. Yes, sir.

XQ182. The two negatives, one for the sound and one for the picture, are printed on the same positive film, are they not? A. I understand the sound and picture to be recorded upon the same strip of film.

XQ183. That is negative or positive? A. Negative.

XQ184. I am asking you now about printing the positive. A. The single strip of film was 255 printed on a single positive strip of film.

XQ185. Were not the two printed separately, that is, was not the picture negative put on the positive film separate from the sound negative? A. On different longitudinally extending portions, that is true.

XQ186. And put on at different times? A. At different times.

XQ187. You are in charge of the Department of Communication engineering, at Cornell, as I understand. Your real field is radio and similar matters rather than photography, is it not?

256 *William C. Ballard, Jr.—For Plaintiff—Cross.*

A. I would not say that, sir. We have during the last few years treated on the subject of sound motion pictures and their technical aspects in connection with this course.

XQ188. Sound motion pictures, yes, but in the photography in connection with sound motion pictures? A. Photography is handled in a different department, sir.

XQ189. That is not in the Department of Communications Engineering? A. Quite true.

257 XQ190. You testified yesterday on page 134, if you want to refer to it in your testimony, with reference to Exhibit 22, that is, the large chart, that it was well-known in the art how to accomplish the step of the patent of copying the two negatives onto one positive film. That has been done innumerable times in the motion picture art, has it not, for printing titles, combining two scenes, and so forth? A. If the desired result is known, there should be not a great deal of difficulty in producing that result.

XQ191. And does the defendant, in printing
258 the two negatives on the same positive film, use anything that was not known long prior to the invention we are talking about here? A. Not having knowledge of the defendant's process other than in the stipulation, I am unable to answer that question in detail.

XQ192. So it is immaterial to you, for the purposes of your argument, whether or not they used what was old or what was new in putting those two things together? A. I can only refer to the defendant's stipulation. I will be very glad to read that.

XQ193. It is not necessary to read that, but

you know of nothing new that the defendant is doing in printing the two negatives on the one positive? A. As far as my knowledge goes—

Mr. Ward: I object unless Mr. Neave makes his question clear whether he is referring to the process or just some machinery for printing this step of the process.

The Court: The witness evidently understood him. He answered it. 260

XQ194. Look at Fig. 2 of the patent in suit. Does that show a film which can be reproduced in a standard projector? A. I am at a loss to know what you mean, Mr. Neave, by "standard projector." Standard projectors, as I understand, have no sound attachment to them.

XQ 195. Standard sound film projector, standard sound and picture projector. A. It would be not very difficult to construct a projector to hande a film of this character.

XQ196. Of course, but the standard projector 261
is not so constructed, is it? A. You will have to define what you mean by "standard projector." If it is one manufactured by the Western Electric Company and in use today, that would be one thing.

XQ197. Do you know of any projector in use today that would take that film in Fig. 2?

Mr. Ward: I object unless Mr. Neave has his questions limited to whether he is talking about a standard projector today or a so-called standard projector as of the date of this patent. There was

262 *William C. Ballard, Jr.—For Plaintiff—Cross.*

none at the time of this application, as far as I know.

XQ198. How long have you been familiar with projectors for sound and motion cameras, sound and picture cameras? A. Since about 1922 or 1923.

XQ199. Have you ever seen a projector which would take that film of Fig. 2 of the patent in suit? A. I have a reproducing equipment in my
263 own laboratory that will do it, yes, sir.

XQ200. And where did you get that? A. Made specially in the early days.

XQ201. So it is only a specially made piece of apparatus that will take that film of Fig. 2 of the patent in suit? A. This apparatus was made before the introduction of the so-called standard projectors.

XQ202. So there are standard projectors, are there? A. I say your standard, the Western Electric standard projector.

XQ203. Do you know of any projector except
264 that experimental one in your laboratory that would take that film of Fig. 2 of the patent in suit? A. I have no direct knowledge of any other projector of that character.

XQ204. Do you find in the original specification of the patent in suit as filed any statement that the sound recorded has slight or otherwise varying differences in tone and intensity? A. I find that the patent refers to the production of speaking films and in order to reproduce or record speech, such slight differences of tone and intensity are, of course, essential.

XQ205. And that is pointed out in the pat-

ent? A. That is pointed out in the third line of the patent "in the production of speaking films."

XQ206. And you read it all from that? A. Not necessarily. There are other places where the character of the record is referred to.

XQ207. Do you find in the original specification as filed any statement that the sound and picture records are both printed on the same side or face of the final positive film? A. I find that by inference, sir. 266

XQ208. What do you get the inference from? A. From line 79: "One can, however, previous to the printing, unite longitudinally together the two developed negative films and then copy this so united negative film in the usual manner." The usual manner was to print the sound record and picture record on different longitudinally exposed portions of the film.

XQ209. It was usual in the prior art to print them on the same side of the same film? A. In connection with the single film system, it was.

XQ210. Do you find any statement in the 267 specification as filed that the coating of the film is all of the same character? A. Except by inference, the reference to the statement made in line 79, in which reference is made to the copying of the so united negative in the usual manner. This process, as was well known, utilized in the usual embodiment of the process, a single sensitized film was used with the records longitudinally spaced.

XQ211. The positive film of Fig. 2 of the patent in suit is a combination or composite print, is it not? A. It is made by exposing the

positive film to the negative picture record and negative sound record.

XQ212. That is what is called a composite print, is it not? A. I don't think the term is particularly applicable in this case.

XQ213. Have you ever heard the term "composite print" in connection with photography? A. Yes.

XQ214. What do you understand is meant by it? A. A composite photograph usually repre-
269 sents an exposure produced by printing, superposing on the same space of film, a number of negative exposures.

XQ215. And you know it only in that connection? A. For the moment, yes.

XQ216. You have referred in your testimony to having previously testified in a talking motion picture case before Judge Nields in Delaware. That was the case of American Tri-Ergon vs. General Talking Pictures, was it not, and it was a 4915 suit on the glow tubes? A. Yes, sir.

270 XQ217. I see that you stated there in cross examination that your association with Mr. Case, which was your first contact with talking movies—what you stated was this: "My particular association was in connection with problems in amplification. That was the principal connection, although I did have opportunity to discuss with him various types of recording lights." That was true, was it not, that was the nature of your association with Mr. Case? A. Yes.

XQ218. Did Mr. Case and his organization or you yourself give any considerable study to

photographic emulsions, developers, and so forth before 1926? A. I have long known Mr. Case in a general way, and before my association with him under this part-time agreement, which began in 1926, had followed his work to a considerable degree from the standppint of general interest. I knew what he was doing, had discussed his problems with him, and on occasion assisted in the solution of some of them.

XQ219. Problems relating to photographic emulsions, developers, and so forth? A. Yes, 272
that was one of the early problems encountered in the Case system.

XQ220. Just what work did you do on that prior to 1926? A. I discussed the matter with him, made several suggestions of one kind or another. I have forgotten the exact details of it at the present time.

XQ221. Did Case make his own photographic emulsions—A. No.

XQ222. Developers? A. No.

XQ223. Whom did he take it up with? A. These problems were handled by large manu- 273
facturers of photographic material. The Eastman Company was very helpful in the solution of these problems.

XQ224. Case took it up first with Eastman? A. I cannot remember—

XQ225. Do you remember when he took it up with Eastman? A. I don't have that in mind.

XQ226. Case used the Western Electric amplifiers, microphones and loud speakers in his work on talking pictures, didn't he? A. A good deal of the Case amplifying equipment was home made equipment. As for as I know the

earliest amplifiers were not Western Electric amplifiers, bue were built in the laboratory; I built a number of them in the form required.

XQ227. Then he did take up the use of the Western Electric amplifiers, microphones and loud speakers? A. That is true, when the Movietone system was commercialized.

XQ228. You spoke of the DeForest patent 1,489,314, there were two separate negatives there, weren't there? A. Yes, sir.

275 XQ229. Those would be separately developed, would they not? A. Yes.

XQ230. In a manner appropriate for each? A. I find no such statement as that, or any such statement of a separate development in the entire patent.

XQ231. You know that they would be developed in a manner appropriate to each? A. I cannot make that statement.

XQ232. It would be absurd to do otherwise, wouldn't it? A. I think it might be obvious to do that.

276 XQ233. It was the practice in the art prior to 1921, to correct as far as possible for under exposure or over exposure by means of under or over development, was it not? Talking about pictures, photographs. A. It is possible to compensate to some degree for inaccuracies of exposure by variations in development, and that was undoubtedly used in certain cases prior to 1921.

XQ234. What was your connection with the Tri-Ergon Company? Did you ever have any connection with that company? A. I have no other connection, other than having been asked to assist in some of their problems at occasions.

XQ235. You mean, is that recently or does that go back? Of course, you have a connection with them in this case, but I am not talking about this case; were you working with them in previous years? I am talking about the American Tri-Ergon. A. I was asked to assist in some work, I think, beginning in the summer sometime of 1930, I think that was the first.

XQ236. 1930. Have you ever had any connection with the German concern? A. No, I have had no connection with the German concern.

XQ237. What work have you done on the 278
glow tube in connection with the American Tri-Ergon? A. None whatsoever. That is, no practical work. I have, as I mentioned before, experted in a case on the glow light for them.

XQ238. Your knew of their use of the glow tube, didn't you? A. In a general way, yes.

XQ239. Have you ever seen it used? A. Seen any glow tube used?

XQ240. Yes. A. Oh, yes, many times.

XQ241. In these talking movie houses? A. I have made thousands of feet of film using it. 279

XQ242. In your laboratory? A. Yes.

XQ243. Are you familiar with the apparatus that was used or advocated by the American Tri-Ergon Company? A. In a general way.

XQ244. The glow tube gives a comparatively low illumination, does it not? A. I would not say that to be the case, sir.

XQ245. It is so low that it works on the lower part or toe of the characteristic curve? A. Not necessarily.

XQ246. Perhaps not necessarily, but that is where it does work, isn't it? A. No, I wouldn't say that.

280 *William C. Ballard, Jr.—For Plaintiff—Cross.*

XQ247. Do you know that? A. I know that it is possible by glow tube recording to get fully exposed negatives made on positive stock. I have done it a number of times.

XQ248. In 1926, you saw that done frequently, did you? A. In 1926, I saw satisfactory sound records made by the use of the glow tube, yes, sir.

XQ249. And they were working out on the toe of the curve, weren't they? A. Some of the
281 records were so made.

XQ250. And all of them were, weren't they? A. No, I do not know that.

XQ251. Were any of them made working on the straight line portion of the curve? A. There are many different types of glow lights, many different types of glow lights will give ample light to fully record the sound when you make it on positive stock.

XQ252. I am talking now of glow lights used in your laboratory? A. I have made records in my laboratory on positive film with a glow
282 light, which I assumed was fully exposed.

XQ253. Did you ever know of the glow light being used on positive film, not on the toe of the curve, on the straight portion of the curve, outside of laboratory work? A. I was conversant, of course, with the tests that were being made in my own laboratory, I have done that in my own laboratory.

XQ254. But speaking of things outside of your laboratory now. A. I have no definite knowledge of what was going on in every laboratory in the country.

XQ255. Are you familiar with the use of the Kerr cell? A. Yes, sir.

William C. Ballard, Jr.—For Plaintiff—Re-direct. 283

XQ256. Do you use that in your laboratory? A. I have had some experiments with the Kerr cell.

XQ257. Do you know of that being used in the actual production of talking movies? A. I understand the Kerr cell has been applied for sound recording by the Westinghouse Company or some other company that is a subsidiary of the Westinghouse Company.

Re-direct Examination by Mr. Ward: 284

RDQ259. I direct your attention to some portion of your testimony on cross examination, and also in connection with your direct questions 44 and 45, wherein you were asked in substance, to state the extent to which the method of the patent had gone in use, and in answering you stated that it was your understanding that nearly all of the larger companies employed this method of recording on separate films and printing together on a single positive in at least a part of their production; and it might also in- 285
clude separate development of these films. Are there any other features of the patentee's process that have gone into extensive use other than these features that I have mentioned? A. These films are simultaneously recorded, that is, the sound and picture negative records are made at the same time, and then these two negative records are successively printed on different longitudinal extended portions of the same positive film.

RDQ260. At XQ149, page 160 of the record, Mr. Neave stated in substance in his question

286 *William C. Ballard, Jr.—For Plaintiff—Re-direct.*

to you, that there was nothing new at the time of the invention of having the sound record and the picture record on the same film, and you answered, "On the same film"—

Mr. Neave: On the same positive film.

RDQ261. You answered, "On the same positive film." Please state what, if any particular
287 process you had in mind answering that question. A. The process that I had in mind answering that question was the old one of recording by sound and picture on the same negative film.

RDQ262. At XQ151 you were asked, in substance, "And there was nothing new in photographing the sound record and the picture record simultaneously on the same negative film," and you answered: "That is true." And you were next asked, at XQ152, in substance, "And there was nothing new in transferring these
288 negatives to a positive film," and you answered "No."

Will you please state what system or systems you had reference to in answering those last questions? A. This, of course, applied to the single film system in which both sound and picture records were made on a single negative film.

RDQ263. At XQ164, you were asked what you thought was disclosed in the patent in suit that is new, and you answered, "I find no reference whatsoever, in the prior art to any system which employs two separate negatives, sound and pic-

289

ture records, develops separately, and prints them in the usual manner on a single positive film."

And at XQ167, page 163, you were asked then: "Then what is new that you do not find in the prior art, that you think is new here, is printing both the separately exposed, separately developed negatives side by side on the same side of the positive film, is that what you mean?" And you answered, "I think that is a fair statement."

290

I will ask you whether in addition to those features you find anything else new in the patent in suit? A. Yes.

RDQ264. By "additional" I mean not mentioned in your answer here. A. Yes, the process of simultaneously recording the sound and picture record and in printing them side by side on different longitudinally extended portions of the same positive film.

RDQ265. That is, without regard to whether they are separately developed or not? A. Yes.

291

RDQ266. At XQ168, you were asked in substance if you did not know it was old and well-known to have the picture sequence and the sound sequence printed side by side on a positive film, and you answered "Yes." Will you please state what process or processes you had reference to in answering that question? A. I had reference to the single film process in which the negative records of sound and picture are made on ths same negative strip.

RDQ267. You were asked by Mr. Neave in substance where in the original specification of

the patent as filed you found the idea of printing the sound and picture negative, or the records of the sound and picture negative, side by side on the same side of the positive film, and as I recall it, you stated that you found that by inference in the fact that they said they should be printed in the usual manner. I will ask you to refer to the last paragraph of that original specification and state whether that paragraph,
293 by following that paragraph, you would or would not necessarily attain that result? A. I believe that this result will be attained necessarily by following the provisions of that paragraph.

RDQ268. Is it not also true that the old system which the patentees referred to and which they intended to improve was that system of printing? A. It is.

RDQ269. Do you find any suggestion anywhere in the specification of any other system of printing or any other relation of sound and pic-
294 ture records on a positive film other than that? A. I do not.

RDQ270. Mr. Neave questioned you in regard to whether you found any disclosure in the original specification of the idea of photographing vocal or other sounds having slight or otherwise varying differences of tone and intensity, and I believe you stated that you found that in the specification where it made reference to speaking films; is that correct? A. Yes, sir.

RDQ271. Is it possible to photograph conversation, talking without having that result? A. It is not.

William C. Ballard, Jr.—For Plaintiff—Re-direct. 295

RDQ272. Are you familiar with the commercial history in this country of the sound picture art with respect to the Western Electric and Case, about which Mr. Neave has examined you? A. I think I am.

RDQ273. Did you have any connection with the matter? A. Yes.

RDQ274. Will you please state what that history is, as you understand it, and your connection with it, giving the dates as near as you can? A. With reference only to the Fox Case 296
organization and the Western Electric, Mr. Ward?

RDQ275. Well, you can take it all in as far as you know it. A. With reference to the Fox Case organization and the Western Electric, about August, 1926, the first commercial public demonstration of motion pictures was opened to the public, and this system employed a synchronized disc record which was reproduced simultaneously with the showing of the pictures. It was sponsored by the Warner Brothers or- 297
ganization, and the apparatus was produced by the Western Electric Company.

Sometime later in that year—I am not quite sure as to the exact date, whether it was still in 1926 or early in 1927,—the Fox Company gave public exhibitions of sound on film, utilizing the equipment essentially similar to that described in this patent. And after that time, apparatus was built for the Fox organization by the Western Electric Company, and theatres were equipped for showing sound on film produced by the Fox organization with Western Electric equipment.

298 *William C. Ballard, Jr.—For Plaintiff—Re-direct.*

RDQ276. That is to say, the sound picture process using sound film rather than the disc record was introduced commercially by Mr. Case, according to your information— A. In connection with the Fox Company, yes.

RDQ276. (Continued.) —in connection with the Fox Company, prior to any commercial installation by the Western Electric Company of a sound film system, as distinguished from the
299 graphophone? A. I think that is true. Of course, it must be remembered that Dr. DeForest gave some experimental demonstrations two or three years ahead of this date, but these demonstrations were not continued and lasted only a few days or a few weeks, as the case may be.

RDQ277. Dr. DeForest started about 1923 or 1924, did he not? A. I think 1923 is the correct date.

RDQ278. And the Western Electric was called in by the Fox Case people after they had the Case system operating, is that correct? A. Yes,
300 that is true.

RDQ279. And they were first called in for what purpose, if you know? A. To supply electrical apparatus, loud speakers and amplifiers.

RDQ280. And do you know whether the so-called Fox Case system at that time in 1926 used the system of this patent in handling the films? I am referring to the very beginning of it. A. The earliest Case films were made with negative sound and picture records on a single negative film.

RDQ281. That is, when they started out they used the old system that the patentees referred to? A. That is correct.

William C. Ballard, Jr.—For Plaintiff—Re-cross. 301

RDQ282. Were you with them up to the time they made any change in that system? A. Yes.

RDQ283. Did they later change over to the system of this patent or not? A. That is true, they did.

RDQ284. Do you remember about when that was? A. I have not any precise date in mind. It was probably sometime in the latter part of 1927 or thereabouts, although that may be several months out one way or the other. 302

Recross-Examination by Mr. Neave:

RXQ285. Just now, as I understood you, you said that the Fox Case Corporation in first using sound on film took both the sound record and the picture record on the one negative and then printed on to a positive? That was it, was it? A. I think that was true in the early films.

RXQ286. And then you said that subsequently they would take the sound on one negative and the picture on another negative, did you not? A. I think I made that statement. 303

RXQ287. And it is true, is it not, that they did that only after they obtained a license with the Western Electric Company and they did that in using the Western Electric interlock apparatus or system, as between the taking of the sound and the picture negative? A. I have no knowledge of that.

RXQ288. You knew they were using Western Electric apparatus when they did that? A. When they took the two separate films?

RXQ289. Yes. A. That was my understanding, that that was the case.

304 *William C. Ballard, Jr.—For Plaintiff—Re-cross.*

RXQ290. They were also then using the light valve rather than the glow lamp, were they not? A. I think the two systems were used alternatively for a considerable period of time in the early part.

RXQ291. And in all of the Fox Case work on talking movies, they used the Western Electric microphones and amplifiers, did they not? A. No, I do not think that is a correct statement.
305 The original demonstration, the first public demonstration in New York of which I have any knowledge, utilized two amplifiers, one of which I personally built, and the other one was built for Mr. Sponable from parts that were purchased in the open market. Neither one of them was Western Electric amplifiers.

RXQ292. What was that exhibition? A. That was an exhibition, as I remember, in the Times Square Theatre. It was not a commercial public exhibition. It was a test exhibition.

RXQ293. Wasn't it the Sam Harris Theatre
306 on 42nd Street? A. I am a little hazy as to the exact location of the theatre.

RXQ294. I have a note that that was on January 1, 1927, and Western Electric amplifiers were used in reproducing. A. Western Electric amplifiers may have been substituted at a later period. The first demonstration did not employ Western Electric amplifiers.

RXQ295. Do you remember that the Fox Case Company first got its Western Electric license as a sub-licensee of the Vitaphone Company? A. I know nothing of that, sir.

RXQ296. And this exhibition, which was not

William C. Ballard, Jr.—For Plaintiff—Re-cross. 307

a commercial one, that you speak of, at some theatre on 42nd Street, that was after December, 1926? A. I cannot place the exact date. I have no means of doing it. I think it was before that period.

RXQ297. When was the first Fox commercial theatre equipped with any sound-on-film system? A. I cannot answer that question.

IT IS STIPULATED with regard to the title 308
papers, including the agreement between William Fox and Tri-Ergon, A. G., Exhibit 8, and the assignment from Tri-Ergon, A. G., to William Fox, Exhibit 10, that defendant waives any objection to the lack of proper notarial acknowledgments in those papers, and that both the assignment and the agreement may be accepted not only as duly proven, but it is further stipulated that the parties who signed those two documents were officers of the company and duly authorized to 309
execute those papers.

Mr. Neave: For the purposes of the present case, we do that.

The Court: That is for the purpose of this case only?

Mr. Neave: Yes.

IT IS STIPULATED that Western Electric or its subsidiary, Electrical Research Products, Inc., has an agreement with the defendant, whereby the former agrees to defend suits for infringement involving any apparatus or processes which West-

ern Electric or Electrical Research Products, Inc., as the case may be, licenses to defendant, and also agrees to hold them harmless of any damages or liability resulting from any such infringement.

Mr. Neave: I agree to that, subject to these corrections: None of the agreements are with the Western Electric Company, as I understand it, but all of them with the Electrical Research Products
311 Company, and there is no agreement with reference to damages, except the Electrical Research Products is to pay and satisfy all judgments and decrees for profits, damages and costs. And I agree that the Electrical Research Products, Inc., is a wholly owned subsidiary of the Western Electric.

JOHN M. JOY, called as a witness in behalf of
312 the plaintiff, being first duly sworn, testified as follows:

Direct Examination by Mr. Ward:

John M. Joy; 60; residence, Yonkers, New York; I am an electrical engineer working for the American Tri-Ergon.

I am familiar with the so-called Tri-Ergon system; I first became familiar with that, about August of 1926.

I think it was in July, 1926, the Tri-Ergon system was brought to the attention of Mr. Fox,

and the indications were that it had some merit, and we decided to investigate it in Europe, and after that investigation, we decided to bring it over to the United States for the purpose of making critical tests on it. I investigated it in Europe for Mr. Fox. I decided to bring it over to this country in order to make critical tests over a longer period of time than was available in Europe. The apparatus was put together, assembled and shipped to this country the latter part of 1926. I think it arrived in New York 314 the last week in December, 1926.

We decided to bring over one of the original inventors, who was thoroughly familiar with the equipment, in order to carry on further experiments here for comparison with the Case system, which Mr. Fox already had taken on, and with other work that was going on in the United States. The idea was to obtain the best possible system for making sound motion pictures. We brought over Dr. Engl, one of the original associated inventors of the Tri-Ergon system, and he was in the United States for about six months, I believe, working at the Fox 315 Laboratories, Fox Studios, especially the studio on 54th Street, which had been equipped especially for the making of sound picture work, and investigations.

The apparatus, when it arrived, was set up there in the 54th Street studio, and various experiments were carried on in connection with first recording, and I think a great many feet of film were made in order to determine the practical results obtained from the system.

Q9. Was any of that film reproduced? A. Yes.

316 *John M. Joy—For Plaintiff—Direct.*

We brought over, besides the recording apparatus, a complete reproducing apparatus, which had been in operation in Germany for some time previous to that.

Q10. Can you tell us whether or not in connection with the system, as it was brought over here, and as tried out in the Fox Laboratories, as you say, they used the single system throughout of recording sound and pictures on the negative and then printing that onto the positive, or
317 what system did they use? A. They used a double system throughout, that was one of the distinguishing features of the system at that time. By the double system, I mean that they took their sound and pictures simultaneously on separate films. Then they were developed separately appropriate to each film. And after they were thus developed they were combined on a common positive. That is the developed negatives were printed then onto a common positive. And when so printed the sound track was in a displacer relation with the picture and alongside
318 of it longitudinally on one edge. I think at that time we were printing the sound track outside of the sprocket holes in order to preserve the original size of the picture. That is, in order to give the full size of the area usually used by pictures to the picture, the sound track was printed outside the sprockets. But otherwise, the same relation that the sound and pictures bear on this Exhibit 22. The standard German projector at that time was arranged to operate in that way. We afterwards printed the sound track in what had become practically the standard American system for the sound track, that is, inside the sprocket holes.

That is, the Tri-Ergon system as brought over here, and the apparatus for recording and reproducing, was arranged in accordance with what I understood to be the general German practice as of that date, in which the pictures occupied the usual full area between the sprocket holes and the sound track was outside the sprockets, but on the same side of the film. And when that system came over here, I say it was customary in this country to have the picture and the sound tracks both inside the sprocket, so we afterwards changed it over to that idea. The positive record, 320
as used in the Tri-Ergon system, when it was brought over, was approximately like Fig. 2, the sprocket holes were standard for all standard machines.

As to the type of sound picture apparatus that Western Electric was putting out at the time, we brought this Tri-Ergon system over here, I don't know that; I can't remember that they had any commercial type of sound recording apparatus available at that time. Possibly they were experimenting in the laboratories. The only sound pictures for reproduction purposes at that 321
time, as I remember, were the Vitaphone, which was a synchronized disc, and Dr. DeForest. The Vitaphone, the synchronized disc, was Western Electric, or a subsidiary of Western Electric. At that time I believe they were putting that out commercially, they were recording to the best of my knowledge on a disc at that time.

Q26. Now, can you tell us aside from the Fox Film people and yourself and Dr. Engl, whether anyone else had access to that Tri-Ergon system and apparatus when it was over here? A.

Oh, yes; the Western Electric Engineers all had complete access to it.

Q28. How did they happen to get access to that? A. Well, I suppose they were interested in all sound picture development—

Mr. Neave: Does he know or is he just guessing?

Q29. State what you know, Mr. Joy? A. They
323 were interested in all sound picture development, and they were trying to interest all producers in their system. They had certain fundamental patents for amplifiers which—

Q30. You mean patents on amplifiers? A. They had amplifiers, anyway, which the producers were practically compelled to adopt in order to produce their motion pictures. There were no other amplifiers available.

Q31. That is, as far as you know, they had the amplifiers which had to be used? A. Yes, as far as I know.

324 Q32. Now, state what you know about their having access to this system and apparatus at this time, giving the time? A. I know that Mr. Otterson and Mr. Drake frequently came to the Fox Laboratories when the Tri-Ergon system was under tests of various kinds, and it was decided to form a committee in order to pass upon the features of the Tri-Ergon system, if they were of any value, and such a committee was formed. Why the Western Electric had representatives on that committee I do not know.

Q33. Did they have a representative on that committee? A. They did, yes.

Q33. Who was it? A. Mr. Drake.

325

Q34. Beyond those last two gentlemen you mentioned, Mr. Drake—and who was the other? A. Mr. Otterson. Mr. Otterson was not on that committee. The committee was organized entirely, as I said, to investigate the features of the Tri-Ergon system as compared to what had been done in America.

Q35. Both Otterson and Drake were Western Electric men? A. Yes. I think Mr. Otterson was. He afterwards became president of Electrical Research Products. I do not know whether it 326
was formed at that time or not, I do not remember.

Q36. And they had full access to this apparatus? A. Yes, not only that, but frequently, at all times, many of their engineers had access.

Q37. They were allowed to come and study to their heart's content? A. Yes.

Q38. Experimenting with it? A. I do not think any experimenting was done.

Q39. Observe its workings? A. Perhaps observe its workings.

Q40. And its results? A. Yes.

This was the early part of 1927, the middle of 327
January, 1927, when we had received all of the apparatus and had it set up in working order. I do not know of any commercial system that had been put out previous to that time by Western Electric with the sound on the film.

Later on they did come out with such a system after having had this instruction and access. I know that they were investigating the construction of all sound, available sound picture apparatus. They investigated and looked over the Case reproducer, and also the Tri-Ergon repro-

328 *John M. Joy—For Plaintiff—Cross.*

ducing apparatus, with the idea of possibly incorporating any or all of the good features of this apparatus in a standard American reproducer which came along some time after that in quantities.

Q44. You are quite certain it was after this date, as far as you know, when this inspection was given Western Electric, that they came out with their sound-on-film system? A. Yes. Their recording system was quite some time after that,
329 I am sure, because there was continual disagreement as to the merits of the glow light recording of Case and a proposed light valve system of the Western Electric, and afterwards they set up and were given facilities in the Fox Laboratories for establishing, I think, one of the first light valve recording apparatuses for making commercial pictures. That was set up in the Fox Studio on 54th Street sometime after the Tri-Ergon system had been taken over by Mr. Fox.

Cross Examination by Mr. Neave:

330 This apparatus that was brought from Germany that I have been testifying about was brought in 1926. It arrived in New York the latter part of December, 1926. And prior to that time the Fox Case Corporation had in this country recorded sound-on-film. That Fox Case Corporation was the sound picture subsidiary of Fox Film.

XQ48. And it acquired a Western Electric recording license as a sub-licensee of the Vitaphone in December, 1926, did it not? A. I think that is correct. It acquired, if I may say, not recording licenses, but amplifier licenses, which were only part of the recording system.

XQ49. And when the first sound pictures were recorded by the Fox Case Corporation here with the sound-on-film in 1926, there was used a Western Electric condenser microphone and Western Electric amplifiers, that is true, is it not? A. I don't think so. The first sound pictures which were recorded in Fox Studios in New York were recorded entirely by Case apparatus. That was in July, 1926.

XQ51. I had a note of the recording in June, 1926. A. It may have been June. I am not positive as to that date. It was certainly not after July, the first recording. 332

XQ52. My note is that the Western Electric condenser microphone and the Western Electric amplifiers were used in recording those films. Is that wrong? A. I know the first apparatus which was brought down from Auburn was set up in the old Fox Studio on 55th Street, and my recollection is that the microphone and the amplifier was one, especially the amplifier, was one that had been constructed by Case for experimental purposes in his own laboratories. After that, I cannot give you any definite date without refreshing my memory. 333

XQ48. Do you recall that short subjects produced at the Fox Case Studios in November, 1926, were shown publicly at the Sam Harris Theatre on 42nd Street in January, 1927? A. I think you refer to Racquel Meller subjects. I did not see those subjects made. At that time I was in Europe. In November, 1926. I remember the showing of those in the Harris Theatre in January, 1927. I am not definite as to whether Western Electric amplifiers were used in reproducing there.

334 *John M. Joy—For Plaintiff—Cross.*

There may have been an all-sound program at the Times Square Theatre in September, 1927, when complete Western Electric sound-on-film reproducing system was used. I recall the reproduction of a program at that time. I should say more than 19 Fox Theatres were equipped with the Western Electric sound-on-film equipment by the latter part of 1927, because the Western Electric had by that time gone into quite extensive production of the reproducing
335 apparatus.

XQ54. Of course, that obviously and necessarily was the result of prior laboratory development; you recognize that, do you not? A. Possibly of information obtained by prior workers in the art also.

XQ55. That is possible. You don't know that? A. I think so. That is my opinion.

The Western Electric Company furnished the Fox Case Company with an electrical inter-lock as between the picture camera and the sound camera early in 1928.

336 XQ57. Prior to that time Fox had recorded sound pictures on a single film, had they not? A. Except for the Tri-Ergon system.

XQ58. That was experimental? A. Not entirely.

XQ59. How did it go beyond that? A. I don't know what you mean by "experimental".

XQ60. Well, Fox had recorded sound pictures on a single film, had they not, and they had done it in regular commercial production, had they not? A. In September, 1927, I should say that they were in commercial production. The Tri-Ergon system. I should say that the Tri-Ergon

system was not experimental at that time. It was practically, at the time it was brought over here, the only reproducing apparatus which had been tested out commercially, and it could have been put into commercial operation much earlier in this country except for the fact that the Western Electric preferred to develop their own standard apparatus.

XQ61. It is a fact, is it not, that up until early in 1928, Fox had been recording sound and pictures on a single film, then they got the interlock? A. Then they obtained the Western Electric more as an experimental apparatus than as a standard recording apparatus. 338

XQ62. And they continued to use it, did they not? A. Not entirely.

XQ63. The interlock made separate films possible with the sound recorder off the set, did it not? A. Yes, that is true. That was an advantage.

XQ64. And Fox had now gone over to the Western Electric light valve recording; the last four pictures having been recorded with it? A. I think they were compelled to go over, not from any choice. 339

XQ65. By competitors? A. By financial pressure, perhaps, certainly not because the light valve technically produced a better quality record than the Aeo light. I think that has been proven and demonstrated that the quality of record produced by either one is about the same.

XQ. 66. Fox did use negative emulsion for the sound negative until sometime in 1929, did they not? A. I could not answer that—

XQ67. They did not begin to use positive emul-

sion with negative sound film until the Aeo light was improved to the point where it would give sufficient light for that purpose? A. I could not answer definitely on that because I have no knowledge of the fact.

The apparatus was shipped from Dr. Engl's laboratory from Germany in the latter part of 1926 or early 1927. And Engl came at the same time. He brought with him a two film combined recording machine and camera.

341 XQ71. And that was involved in what you call the Tri-Ergon system, was it not, to have a combined camera for the sound and picture? A. The camera for the picture and the camera for taking the sound are separate. They can be combined or removed one from the other. In this particular apparatus that came over here, they were combined. By "combined" I mean that they were driven synchronously from a single motor. Of course, the film for the picture had to run intermittently, and for the sound continuously.

XQ74. And then you got the vibrations in that
342 combined camera due to the intermittent action? A. No, because this camera was especially built to eliminate such vibrations.

Engl brought with him his own amplifiers, the Tri-Ergon amplifier which had been developed, a condenser microphone; also various types of microphones, and the Cathodophones. The latter was an electron discharge device used as a microphone. It was not entirely a glow discharge. That device was used commercially in Germany. It was used there; I don't think that it was developed to the point of being a commercial device, but it was used over continuous periods for making pictures, sound pictures.

XQ84. But you say it was never developed into a commercial device? A. I mean it is one of those things that has not been standardized for commercial production in large quantities.

XQ85. It had an extremely short life, did it not? A. Under the old condition which you probably refer to, its life, I would say, would be short.

XQ86. About 50 hours, I am told? A. Possibly; but since that time it has been improved, and I know that fundamentally it has some very good features that are superior for microphonic 344
work over some of the microphones that are used at the present time.

Engl, when he came here in 1927, had with him a reproducer for 40 millimeter film. That was a standard machine for sound-reproduction purposes in Germany at that time. It became standard because it was the only one of its kind which had been successful in reproducing pictures, sound pictures, commercially. They adopted the idea of the overhanging sound track in order to preserve the full size of the picture.

XQ92. Were the standard machines of Ger- 345
many at that time designed to take a 42-millimeter film or 40-millimeter? A. In that respect it was not standard, but in regard to the sprocket spacing, it was standard. The changes necessary in the German machine were to make the gate wider and to provide some attachment for picking up the sound. That, of course, was—there was no particular one at that time which was standard for any sound-reproducing. They tried to use as much of the standard features of the picture projector as possible.

346 *John M. Joy—For Plaintiff—Cross.*

XQ93. I have before me a translation of an article by Hans Vogt, published in 1925, and entitled "The reproduction apparatus for picture tone films of the Tri-Ergon, A. G., of Zurich." Dr. Vogt there states that for certain technical reasons, a projection apparatus of the Ertel concern in Munich was employed—

XQ93. (Continued.) And then Dr. Vogt proceeds to say: "In so doing, it was necessary to be sure to widen the film guidance in such a way that the picture tone film with a width of 42
347 millimeters could pass through it." Is that your understanding of the work that had to be done to adapt this 42-millimeter film to the projectors as they then existed? A. Well, you would certainly have to widen the gate of the picture machine in order to pass a wider film through.

When Engl was here with his apparatus, he recorded the sound on one film and the pictures on another. And each of those films was of standard width. He had a special printer for printing the two records on a 42-millimeter film. And he brought over with him some pictures
348 that had been recorded in Germany, in addition to making some recordings in the Fox Case.

XQ99. And then the result of that work, or, rather, what you got from the reproduction of those films, was compared, was it not, with the then existing Fox Case system? A. The same films were not compared.

XQ100. No, of course not, but the quality and tone, and so forth, was compared? A. That was done at various time, many times.

XQ101. And the reproduction turned out not to be as good as in the Fox Case Movietone, did it

not? A. I don't know. There was a difference of opinion on that.

XQ102. But in any event— A. Some films, as I remember, were just as good as the Fox Movietone.

XQ103. In any event, after these comparative tests, Fox, as a matter of fact, continued his Fox Case system, did he not? A. Yes; and he also exercised his option and took up the Tri-Ergon rights.

XQ104. You mean Mr. Fox personally did that or am I speaking of something in litigation? 350
That was my understanding, that Fox himself did. A. That was my understanding.

Then, I think, Engl returned to Germany in June, 1927. Engl was here in 1929.

XQ107. And he brought with him a reproducing outfit adapted for standard width film, did he? A. I am not sure that Engle was here in 1929. I would like to correct that.

About that time there was sent over from abroad some apparatus that had been redesigned so as to produce a standard width film; I brought that back myself. That was brought to Mr. Fox's 351
attention at that time.

XQ110. But Fox continued to use the Western Electric system? A. Western Electric reproducing apparatus, I do not know—

XQ111. And the recording apparatus, too? A. That is very true, because he had a license agreement with them previously to that.

XQ112. Have you any experience at all with the glow tube used in recording? A. What do you mean by "experience"?

XQ113. Have you ever used it yourself, are you that kind of a person? A. Why, I have been

352 *John M. Joy—For Plaintiff—Cross.*

present many times when recordings have been made with the glow light.

XQ114. What about the illumination, what part of the characteristic curve did it work on? A. It depends on what particular glow tube you refer to, I think.

XQ115. Wasn't it part of the Vogt system and idea that you would use this glow tube which gave low illumination, working on the lower part of the toe, as they seem to call it, of the characteristic curve, so that in the negative, after
353 it was developed you had distorted values, and then by printing also on the positive on the same toe of the curve, you corrected those values, those abnormal values, so as to approximate normal values in the final positive? A. I think the idea of recording on the toe part of the curve originated in America. The particular glow light that the Tri-Ergon system used at that time had a higher intrinsic brilliancy than the glow lights that were being used in the United States. As regards to the distortion of the print, they did develop an idea in which by developing the
354 negative to a higher gamma, it was sought, intended to avoid that distortion in the emulsion by correcting it by overdeveloping.

XQ116. That development accentuated the defective values, didn't it? A. Well, I do not know, I am not prepared to discuss that.

XQ117. Do you remember that Vogt had a patent on that? A. All three inventors had a patent on it, in which the real idea, I believe, was to overcome that distortion, and at the same time have a transmission value of a postive of about fifty per cent. of the unmodulated sound track.

XQ118. The earlier sound recording of the Tri-Ergon Company, the German one, I suppose, was on the same negative as the picture, wasn't it? A. No. I can't definitely answer that, that is that they never recorded on a single negative, but if they did, they went to the double system as being more advantageous for sound picture work.

XQ119. For reasons of development, I suppose? A. Partially, and other reasons that flow from it. 356

XQ121. What other reasons? A. Well, for purposes of editing the film, purposes of adding sound effects, which are not feasible always to have when the picture is being made on the set.

XQ122. I do not understand that about editing, I should think it would be well to have them all on one film for editing, because if you edit the picture, you edit the corresponding sound track, do you not? A. It is more difficult to edit the sound with the picture, if it is all on one film. It can be done better by putting them on separate films. To edit means to take out or put in some- 357 thing.

XQ124. If you take out sound or put in sound, you have to take out and put in some picture, too, don't you? A. Sometimes the sound is very bad, on a bad film, and it can be corrected by putting in additional sound.

XQ125. A correction rather than by adding something to the length of it? A. Well, it is called, I think, in the film industry, editing the film.

XQ126. Tell me something more about this committee that you were speaking of, on which

358 *John M. Joy—For Plaintiff—Cross.*

some Western Electric representatives sat. Frankly, I know nothing about the committee, and by telephoning we can't find out if those people sat on the committee. A. Ask Mr. Drake.

XQ127. We have asked him. He does not recall any such committee. A. His memory must be very bad then, if he doesn't remember.

XQ129. Will you tell me more about where they met, how many there were, and what they did, so that I can trace it somehow? A. I think
359 there were two Western Electric men, Mr. Drake and Mr. Crandall.

XQ130. I thought you said Otterson? A. I didn't say Otterson was on the committee. Mr. Otterson frequently was in the studio. Crandall is now dead. I think he was associated with the condenser microphone.

XQ132. Tell us something about the committee, who was on it? A. Mr. Sponable of the Fox Case Corporation, Mr. Engl and myself were on that committee.

360 XQ133. Where did you meet? A. We met several times at the 54th Street studio. We had dinner several times in various places, I can't remember.

XQ134. Did that committee have any technical name? A. The committee had no technical name, no.

XQ135. It was a committee of what? A. A committee of technical men. Mr. Drake did not consider himself a technician, but more from the commercial angle. The idea of this committee was to investigate all of the Tri-Ergon apparatus.

XQ136. The members of the committee were

appointed by whom? A. I do not remember now who.

XQ137. To whom did the committee report? A. Mr. Courtland Smith was, as I recollect now, the originator of that committee.

XQ138. Who was he? A. He was at that time in charge of the Fox Movietone, Fox Case Corporation.

XQ139. Who invited those gentlemen to sit on that committee? A. I think he did. 362

XQ140. To whom did the committee report? A. I think they reported to him.

XQ141. Did the committee ever keep any minutes? A. They kept records, I think each individual kept notes, naturally.

XQ142. Have you got your notes? A. I can't tell you that.

XQ143. Who was the chairman of the committee? A. I think Mr. Sponable was chairman.

XQ144. Who was secretary? A. I really can't tell you now.

XQ145. Did they ever render a report to anybody? A. I did, personally. 363

XQ146. As a committee, I mean. A. I do not know.

XQ147. I rather gather it wasn't really any formal committee of any organization or anybody, but just you four or five gentlemen got together and talked things over? A. Well, it was a sort of informal committee but its object originally was to get a fair estimation of the Tri-Ergon system, the various features concerned in the Tri-Ergon system.

XQ148. In what year did that exist? A. That was in the early part of 1927. I should say it was

364 *John M. Joy—For Plaintiff—Cross.*

organized in the early part of January, possibly February of 1927.

XQ149. And lasted until when? A. Well, until about June, or until the option was taken up by Mr. Fox.

XQ150. And the Committee rendered no report, as far as you know, as a committee? A. I do not know what report the Western Electric members of the Committee made.

XQ151. But I mean the committee, as such,
365 made no report? A. Not as a whole.

My experience with these Tri-Ergon matters goes back to about July, 1926.

XQ153. Do you remember what kind of a film the Tri-Ergon people used, wasn't it a very heavily bromided film? A. I couldn't tell you. I couldn't tell you about the developing characteristics now, I have no recollection and no notes here.

I do not fluently read German.

XQ156. I have a translation here of what purports to be an article of Hans Vogt in a German
366 publication called the Film Kurier. Will you look at that and tell me if you have read that publication, which purports to have been published in 1932? A. I have never read this article.

XQ157. Did you notice in reading this article, as I handed it to you, Vogt apparently says, with reference to what he calls his invention protecting the separate developer that he himself was the personal inventor, did you notice that? A. I did not.

Mr. Ward: I object to that question.

The Court: He said he did not read it.

Mr. Neave: He said he did not notice it, so I can't get very far with it.

Mr. Ward: I think it is an unfair way of trying to get statements of that kind in the record.

The Court: It does not amount to anything.

XQ158. Do you know anything on that subject? A. I know considerable about Mr. Vogt, yes, which I do not want to put on the record, for your sake.

I wasn't in Berlin in 1922.

Re-direct-Examination by Mr. Ward: 368

RDQ160. Mr. Joy, do you know whether Mr. Vogt was connected with the Tri-Ergon Company or the American Tri-Ergon Company or any of its affiliates in 1932, when this alleged article was written? A. He was not connected with the American Tri-Ergon or with any Tri-Ergon Corporation.

RDQ162. Do you know whether at that time in 1932, he was connected with any company or organization antagonistic, at that time, antagonistic to Tri-Ergon interests? A. Well, I know that 369 overtures were made to him by companies antagonistic to the Tri-Ergon interests.

RDQ163. You had some personal connection with Mr. Vogt with relation to that general matter, did you? A. I did, in May, 1932.

Mr. Ward: Plaintiff rests, your Honor.

Mr. Neave: Mr. Hoffmann, will you take the stand?

The Court: Is this further cross-examination?

Mr. Neave: There are some corrections I want to make. I should think it is further cross-examination, but I don't care.

370 *Louis B. Hoffmann—For Plaintiff—Recalled—Cross.*

LOUIS B. HOFFMANN, recalled.

Cross Examination (Continued) by Mr. Neave:

XQ173. Look at the bottom of page 113, XQ166, of your testimony I asked you: "In that work with those developers with the Fox Film, can you tell me what the gamma was that you used for the positive?"

371 And you said: "In the vicinity of the gamma of 2." Am I right in understanding that the gamma was in the vicinity of 2 for the sound negative and the sound positive and for the picture positive? Of course, that is not what the question and answer said. I am expanding that. A. It cannot be all three of them.

XQ175. Then we will take it step by step. I will try to shorten it. My question there, referring to the positive, what did you understand that to be; the sound positive? A. The printed positive.

372 XQ176. The final positive? A. That is correct, the printed positive.

XQ177. What was the gamma for the sound negative? A. In our experimental work we developed the sound negative in various different manners, one of which was the so-called straight line processing, in which the negative sound gamma was approximately .5.

XQ178. And you also used for the sound negative a gamma of 2, did you not? A. We did develop some sound negative records, which had been made on a positive emulsion in which the straight line portion of the characteristic curve indicated a development at a gamma of 2.

Louis B. Hoffmann—For Plaintiff—Recalled—Cross. 373

XQ179. And on the negative stock, what gamma did you use? A. I can speak now only of the experimental tests that we made, because in the case of the sound records that were made for the news work, the sound was recorded on the same film with the picture. In the case of the sound records made on negative film, in our experimental work, the gamma of development was .5.

XQ180. Now, look at cross-question 167—

374 Mr. Ward: Your Honor, I think I would like to have it understood that Mr. Neave is calling this witness his own. He has gone way beyond the bounds of the direct examination. He is taking him into his experiences with the Fox Case Company—

Mr. Neave: This is cross-examination.

Mr. Ward: —before this patent was issued, as I understand. It has nothing to do with the situation.

Mr. Neave: I am straightening out this cross-examination.

375 Mr. Ward: Even that is beyond the bounds of any kind of cross-examination.

XQ181. Look at the top of page 114, cross-question 167: My question was: "And for the negative?" And your answer was ".5 to .6". Was that the picture negative you were speaking of? A. Yes, sir.

XQ182. And the picture positive and the picture negative had a gamma of 2, is that right? I beg your pardon. And the picture positive and the sound positive had a gamma of 2? A. In the vicinity of a gamma of 2.

376 *Louis B. Hoffmann—For Plaintiff—Recalled—Cross.*

XQ184. That is right. Then look at XQ168. The question there was: "And the overall?" And the answer was, "It was slightly greater than unity." What does that mean? Does that mean it was slightly greater than unity for the picture and about 4 for the sound? A. I had in mind there the experimental work which was done in which the negative sound record was developed to a gamma of .5, and the final printed positive developed so that the picture had a
377 gamma slightly greater than unity, as I mentioned there. By that I mean slightly in numerical figures, but greatly in the contrast as viewed from the screen.

XQ185. Slightly greater than unity for the picture? A. That is right.

XQ186. Now, what was it for the sound? A. The figure for which we planned was to have the overall gamma of sound unity on this experimental work.

XQ187. On the negative stock, when you were using negative stock? A. Positive stock or nega-
378 tive stock.

XQ188. You have been speaking about experimental work, what did you do in your regular work, what was the overall gamma in your regular work, for the picture, slightly greater than unity? A. The overall gamma of the picture, I know for a fact in February of this year was between, the limits of 1.2 to 1.3, or 1.4.

XQ189. And that is what you did in the olden days, that you are talking of in your testimony here? A. That is the work that was actually done in connection with the production releases of the Fox Film Corporation.

XQ190. And for the sound commercial work in the sound, what was the overall gamma? A. The overall gamma, if you used the slope or the straight portion of the characteristic curve as an indication, the overall gamma, would be 4. However, that isn't entirely correct because of the fact that the exposures were on the toe portions of the curve in the case of the sound negative which is recorded on the positive film.

XQ190-A. I am a little confused but I thought 380
at the beginning of my questioning this afternoon, you said that the gamma of the sound negative was in the vicinity of 2, and then I thought that in your answer you gave me just a moment ago—I beg your pardon, not in the vicinity of 2, in the vicinity of 1.5, and then the answer you gave me a moment ago I thought you said that the gamma for the sound negative was about .5. Which was right? A. I do not remember that I said 1.5.

XQ191. I may have misunderstood that, but in your commercial production the gamma for the 381
sound negative was about 2, wasn't it? A. I believe I answered that question previously by saying that the slope of the straight line portion of the characteristic curve which indicated the degree of development of the sound negative was two, approximately 2.

XQ192. Now, look further down on page 114 to XQ170, the answer there is: "I mean from .1 to 1.2". That should be, should it not, "I mean from 1. to 1.2". XQ170. The decimal is in the wrong place in the transcript, is it not? A. Yes, that is correct; that is what I intended to say, 1.1 to 1.2.

XQ193. 1. to 1.2, isn't that it? Not 1.1? It should read 1. to 1.2? A. We are talking about slightly over unity, so it couldn't be 1.

XQ194. But your answer was from 1. to 1.2? A. If you read that in connection with cross-question 156, it would be very obvious, if you multiplied the figure 2 by .5 the product is 1, but I did not intend that that figure of 2 should be an exact figure. I said in the vicinity of the gamma of 2.

383 XQ195. I understand that perfectly. Will you look at XQ170. Is the answer as there typewritten correct? A. It is typewritten .1 to 1.2. That is not correct.

XQ197. What is the correct answer to that question? A. 1.1 to 1.2.

DEFENDANT'S PROOFS.

HENRY NONNENBACHER, called as a witness on
384 behalf of the defendant, having been duly sworn, testified as follows:

Direct Examination by Mr. Neave:

I live on East 175th Street, and am Building Superintendent for the Actinograph Corporation.

I have been connected with the motion picture industry since 1906.

I entered the employ of the American Mutoscope & Biograph Company in 1908, a motion picture producer. I was film superintendent, over in Hoboken, New Jersey.

Prior to that time I experimented as an amateur photographer, since 1885.

I then went over to Germany.

I studied there on the developing of plates and films. I came back to America, in the latter part of 1903. I brought back an agency for photographic chemicals. I continued that work for a little over four years. Shortly after 1907 I went to the Biograph, to supervise the developing of negative, printing and assembly or joining, as it was called.

The Biograph Company discontinued producing pictures in 1916. 386

I remained superintendent of the film laboratory until 1913. I stayed afterwards in their employ, however, as cameraman.

The Biograph produced a picture having the title "The Music Master," while I was superintendent of the film laboratory. That picture was released on the 6th of May, 1908. I had charge of the development of the films for that picture. These films are the two scenes from "The Music Master." These two are both original negatives.

I personally located these two pieces of film for use in this case. 387

They were stored when I found them in the laboratory at 176th Street, as we ran the Actinograph in the vaults of the Actinograph Corporation.

That vault is a film library of the former Biograph Corporation. I had charge of that film library at the time. Ever since 1908.

Mr. Neave: I offer those two negatives in evidence.

(Marked Defendant's Exhibit A in evidence.)

388 *Henry Nonnenbacher—For Defendant—Direct.*

The Witness: The Biograph Film Laboratory was continued after picture production ceased in 1916.

Q35. What did they continue to do? A. Commercial, for other producers.

This old book here, I recognize, it is a collection of little circulars and leaflets that were sent out over a period of years to the different distributors both in this country and foreign. Sent out
389 by the Biograph originally, and then later the Mutoscope Corporation.

There are a good many circulars in that book. Those were collected and bound up when they got to be that size, they were saved and put into books.

I always had this book in my charge.

The circulars in that book cover the period from March 2, 1907. I do not remember the dates. To March 30, 1911.

The circulars were printed before the picture was released. That book contains a circular for
390 this Music Master, the negative films of which have just been put in evidence.

Q44. I have here what purports to be a reproduction of that circular. Just compare it and see whether the reproduction is like the original. A. Yes, sir.

Mr. Neave: I offer in evidence that sheet, the Music Master. As part of the prior art.

Mr. Ward: Just as part of the prior art, not anticipation.

Mr. Neave: That is right.

(Marked Defendant's Exhibit B in evidence.)

The date of this circular, it is rather indistinct in my reproduction, is May 6, 1908. This circular uses the words "phantasmagorical portrayal of his thoughts." That means a vision. This description on this circular refers to the picture of which I have produced the negatives here as Defendant's Exhibit A.

Q48. Will you tell us how those negatives were made and printed? A. How the original negative was made?

Q49. Yes. There are two negatives wound on 392
the same roll in Exhibit A. A. The scene of the set was taken straight by the cameraman; and the vision was taken by using a mask in the aperture of the camera, and taking a second negative. That is all the camera had to do.

Q50. So far you have got two separate negatives? A. Yes, sir.

Q51. Then after getting those two separate negatives were they separately developed or not? A. Both separately developed.

Q52. And then after you got these two negatives what did you do with them? Did you print 393
one positive from them or two positives? A. We printed one positive.

Q53. How did you do it? Just describe how you did it. A. We took the scene of the set first on a special machine, and we had a glass slide which put a small dot so that it would not print.

Q54. Yes. A. (Continuing.) And one negative was masked with a grid; where we started a print it is negative completely. We rewound that film positive. In other words, the print took the scene in which had just a still part of the first mask. We ran that print through on that second negative where it had been mounted.

394 *Henry Nonnenbacher—For Defendant—Direct.*

Q55. So these two negatives were printed on one positive? A. Yes.

Q56. Consecutively? A. Consecutively.

The Biograph library contains no positive prints of the old negatives. They have to be destroyed after a given time. That was the practice at that time.

This is a print of the two negatives that you have just shown me.

Q61. That is the positive? A. That is the pos-
395 itive, made recently for us.

Q63. Does it clearly show how the two negatives— A. Yes, sir.

Q63. (Continuing.) —effected the one positive? A. Yes, sir.

Mr. Neave: I offer that positive print in evidence.

Mr. Ward: Objected to as irrelevant and immaterial.

The Court: Received. This is still to show the state of the art.

396 Mr. Neave: Yes, your Honor, just to show the ordinary practice of composite printing. They were two separately taken negatives, developed separately, and then printed on one positive film.

(Marked Defendant's Exhibit C in evidence.)

In those old days there was more than one set of positive prints made from the Music Master negatives at the Biograph Film Laboratory. A great many sets. 50, 75, and foreign orders would probably run to 100. Distributed both here and abroad.

By Mr. Ward:

XQ68. As I understand your testimony with regard to the two negatives that you have in evidence, they have nothing to do with sound pictures, just simply plain motion pictures? A. Yes.

XQ70. You took a motion picture camera and took a negative of an old scene or part of a scene, and these parts you took out first, what is that first negative? How did you take that? A. The 398
scene, that was taken full. The full scene was taken.

XQ72. Then was that negative developed? A. Yes.

XQ73. Then what did you do next to get this other negative that you show here accompanying it? A. They were both sent over at the same time from the studio.

XQ74. How did you take the second of these two negatives? How did you get those images on there? A. I did not take them. I was not the cameraman at the time. I had nothing to do with 399
it. I know how they were taken, but I did not take them.

XQ77. Tell us how you know. A. Because I was very well acquainted with the cameraman and was in touch with him right along. I did not see him take them.

XQ79. You only know what he told you? A. I know what he told me, and he gave me the proofs.

XQ80. All you know is that the cameraman took these and told you how he took them? A. Yes.

XQ81. And you got the proofs? A. Yes.

XQ82. Then it is just hearsay as to how they

were taken? You can only testify from what you heard that cameraman tell you? A. Yes.

XQ83. But your belief is that one negative was taken of the full scene, and then that after that there was some projection and another negative was taken of a part of the scene? A. Yes.

By Mr. Neave:

Q84. These two films, these two negatives came
401 to you to be developed at the same time? A. Yes.

Mr. Ward: I object to the witness' testimony on the ground that it is hearsay.

Q85. It is not hearsay that these two negatives came to you for development, is it? A. No, sir; they came to me to be developed.

The Court: You already have it on the record. He tells you it is hearsay, and it would be hard to pick it out and strike it
402 out as to the hearsay parts, but the answer is there.

Lloyd A. Jones, called as a witness on behalf of the defendant, being first duly sworn, testified as follows:

Direct Examination by Mr. Neave:

I live in Rochester, and am employed by the Eastman Kodak Company, as chief physicist in the research laboratory.

403

At the present time I am responsible for the initiation of research work in the Physics Department, for the direction of that work and general supervision of the work going on in that laboratory. I have been with the Eastman Company 20 years.

I received the degree of Bachelor of Science in Electrical Engineering at the University of Nebraska in 1908, and following that, I took two years of post graduate work, resulting in a degree of Master of Arts from the same university. After I received my master's degree and before I went to the Eastman Company, I went to the Bureau of Standards. During the first year of my service there, I worked under Dr. Middlekauff in the photometric division. My duties included the calibration of candle power standards, and research in other lines of photometric investigation. Then I was transferred to the optics section. And I worked there under Dr. P. G. Nutting, who at that time was a very eminent physicist in the field of optics. And under his direction, I worked at various optical problems, including microscopy, photomicrography, colorimetry, spectophotometry, and similar specialized work in the field of optics.

404

405

As to how I happened to go with the Eastman Company in 1912, in 1912, Mr. Eastman engaged Dr. C. E. K. Mees, an eminent British Scientist in the field of photography, to organize a research laboratory. And he came to the Bureau of Standards in order to obtain some one to take charge of the physics department, and he engaged Dr. Nutting. Dr. Nutting asked me to go with him as his assistant.

406 *Lloyd A. Jones—For Defendant—Direct.*

As to my experience with the Eastman Company and elsewhere since 1912, the character of work I have been doing,—during the first years of my service with the Eastman Company, I worked largely on photographic sensitometry. That includes the measuring of the characteristics of photographic materials; on the theory of tone reproduction on visual sensitometry, which includes the study of the way in which the human eye sees things; also upon problems of
407 illumination, particularly bearing on photographic work, also in colorimetry, or the measurement of color.

In 1915, Dr. Nutting resigned, and I became the acting head of the department and continued in that capacity until about 1916, when I was loaned by the Kodak Company to the Submarine Defense Association, which was a civilian organization endeavoring to find means of combatting the ravages of German submarines on American ships. My work with them was in the nature of protective coloring for vessels to make them
408 more difficult to see. When this country entered the war in 1917, I accepted a position, a commission as lieutenant, senior grade, in the United States Navy, and continued in the same general line of work, that is, the problem of camouflage.

After the war, I returned to my duties at the Eastman Kodak Company, and was given the position as Chief Physicist, and since that time, my work has been largely in the initiation of research work and direct supervision of that work.

I have made some contributions in that period, a number of scientific contributions to the art

of photography, especially in connection with tone reproduction in photography, tone reproduction is the one thing to which I have given a great deal of attention.

That work has brought me in contact with the motion picture industry quite closely.

My contact with the motion picture industry began in about 1918, and since that time I have been very closely in contact with many of the problems of the industry. I have spent some time in the laboratories where the films are 410
developed and printed, particularly working on the problems of standardizing the practice; also a considerable time in the motion picture studios where the pictures are taken, and my attention has been given mostly to problems of illumination, the way in which the set to be photographed is illuminated, the characteristics of the light sources that are used, the characteristics of the materials which they have to photograph.

I have also studied the problem of exhibiting the pictures to a certain extent, especially in theatres, and in that particular case, I have 411
devoted time to the devising of better methods of illuminating motion picture theatres.

Q15. What was your or the Eastman Company's interest that induced you to take up this motion picture work? That is, you were selling the film to them, is that it? A. No, I have never been in the sales department of the organization.

Q16. I mean your company was. A. The company, of course, is very interested in selling the film, and they are very interested in having the film and its products used under the very best possible conditions.

412 *Lloyd A. Jones—For Defendant—Direct.*

Q17. You are a member of a lot of learned technical societies, aren't you, I believe? A. Well, I am a member of several. I am a member of the American Physical Society, and the American Astronomical Society. I am a charter member of the Optical Society of America, and was for one term president of that organization, and I am a member of the Society of Motion Picture Engineers, and was for a time president of that organization and chairman of the Program Com-
413 mittee.

Q18. And you established the institute of applied optics at the University of Rochester? A. I participated in the establishment of that institute and am at the present time one of the governing board, or controlling committee of that institution.

Q19. Is the art and practice of photography quite old, or is it just recent? A. I should say it was quite old. It began in about 1800. I think it was in 1802 that Wedgewood succeeded in getting an image on sensitive silver salts, which,
414 however, were not permanent, and in 1822, Neipce made, I believe, the first permanent photograph; that was made on bitumen. And in about 1839, Daguerre introduced a process known by his name which consisted in taking a polished silver plate and sensitizing it by subjecting it to the fumes of iodine which formed a coating of silver iodide. This was then exposed, and developed by means of a exposing it to the fumes of mercury, it was then fixed.

Commonly called Daguerrotype.

In 1881 Scott Archer introduced the wet collodion process, and a little later Neipce St. Archer introduced the albumen process.

About 1870 Maddox, an Englishman, produced a gelatine bromide emulsion, and in about 1875, George Eastman, in this country, who was the pioneer, at least in this country, produced satisfactory dry plates. This was a great step in the perfection of photography, because prior to that time it was very difficult to make photographs especially in a portable way on account of the cumbersomeness of the apparatus. Then about 1880, Eastman succeeded in making a flexible transparent support out of cellulose nitrate, which has by this time almost completely replaced the glass which was previously used.

Q20. How long after Eastman produced that flexible film did the work on motion pictures begin? A. Well, work on the making of motion pictures had already begun when he produced that. As a matter of fact, the demand of the motion picture people who were working on motion pictures was one of the incentives, and in about 1893 or 1894, motion pictures, as we know them now, were successfully produced.

Q21. Those were short films, then, weren't they? A. Yes. At that time, of course, they made the very short films, 100 or 200 feet runs, and they were mostly in the nature of novelties, comedies, and they were exhibited first, of course, in small store rooms, and improvised theatres. Then a little later, they began making the longer pictures of 1000 feet, and following in about 1900, the industry took on quite a different character, and the films manufactured began to have real entertainment and dramatic value. From that time on, the growth has been very rapid and remarkable.

418 *Lloyd A. Jones—For Defendant—Direct.*

Q22. And the motion picture industry is one of the largest in this country now? A. It is one of the larger industries, yes.

Q23. Has the Eastman Company made and sold motion picture film to the motion picture industry from the very beginning? A. Yes, it has manufactured film ever since about 1890, I believe, and since that time, it has made enormous quantities which have been sold in this country and a large amount has been exported.

419 Q24. You have studied the patent here in suit, this Vogt patent? A. Yes, I have.

Q25. The first three paragraphs of this patent which have been read to the Court several times seems to indicate that the difficulties that these patentees thought that they were overcoming or were seeking to overcome was that the picture negative was necessarily, from the circumstances of its then production, over exposed in some parts and under exposed in other parts and as a result of that, and that not being the condition of the sound negative taken

420 at the same time, the patentees seemed to wish to have separate sound and picture negatives. Do you gather anything different from these first four paragraphs was the cause of the over exposure and under exposure of the picture negative that these patentees were going to get some advantage they thought by having separate negatives? A. Yes, that is the case as I understand the patent; the object of the invention was to provide different development treatments for the different picture scenes.

Q26. And that was because why, what was the disclosure, as you understand it? A. Be-

cause it was the usual thing at that time in the making of motion pictures to have over and under exposure between various scenes, and in order to correct for that certain practices of over or under developing were used.

Q27. Do you find the disclosure of any other thought as a basis for what is set forth there? A. No, I do not.

Q28. What width of film was used for transparent pictures prior to the advent of sound? A. 35 millimeters wide.

Q29. Has that width persisted for sound pic- 422
tures? A. Yes, that has been in common use for many years, almost universally.

Q30. Do you find disclosed in the patent in suit a positive sound and picture record on a film of standard width? A. No, I do not.

Q31. Could the film in Fig. 2 of the patent be reproduced on a standard motion picture projector? A. No, it could not. It is wider, obviously wider than the standard 35 millimeter film; hence would not run through the gate on a standard motion picture projector. Moreover, it 423
would require wider reels, deeper magazine and different side strips for the magazine and so forth.

Q32. Fig. 1 of the drawings, and the descriptive portion relating to it, seems to contemplate that the sound record should be made on one film, and the picture record on another film, and then they print from that onto a positive, that is it, isn't it? A. Yes.

Q33. What are the steps in that process? A. That process involves the exposure simultaneously of the sound and picture records, the sep-

arate development of those, and then the printing of those two onto a single positive film. The patent also—I think that is the disclosure.

Q34. Now, Fig. 3 of the patent seems to indicate that the sound and the pictures are to be taken simultaneously on one negative, and then the negative is to be split longitudinally and then separately developed, and then the printing on a positive. How many steps does that involve? More than the first? A. Yes, that involves
425 one more step than in the previous case. It involves the simultaneous exposure of the picture and the sound on the negative, the separating of the two records, the separate development and the printing into a single film. It also possibly involves the reuniting, in which case that would make a five-step process instead of a four-step process.

Q35. Are the sound records shown in all the figures of the drawings of the patent in suit of the variable density type? A. They are.

Q36. What other types exist? This is just
426 as a matter of general information. A. The variable area type.

Q37. In the variable area the sound record region looks sort of saw-toothed? A. That is correct.

Q38. In this variable density type, that is the principal one used now, is it? A. Yes, it is chiefly used.

Q39. I think you said in describing the process in connection with Fig. 3 of the patent in suit, you said that the two negatives were, or you said that after the one negative had been divided so as to make two negatives, then the

development took place, and that those two negatives could be united for printing on the positive. Take the two negatives of Fig. 1, after development they could be united for printing on the positive just the same, couldn't they? A. Yes, that is true, surely.

Q40. Is there anything that is definite at all that is meant in the photographic art by the term "character of development" or "character of treatment"? A. Yes, there is a very definite meaning to that.

Q41. What does that mean? A. That applies 428
to the factors of the developing process determined largely by the composition of the developing solution which control the character of the developed silver image, particularly its granular structure or its color. It also refers to the shape of the characteristic curve, that is, the differences in shape of the characteristic curve other than those which normally occur as a normal function or a normal behavior with increasing the time of development in a given developing bath.

429

Q42. We have been referring here from time to time during this trial to the characteristic curve of a photographic material, but I do not think we have had any precise definition of what is meant by that. What is that? A. The characteristic curve is that relationship which is obtained—well, I might express it qualitatively first: It expresses the relationship between the density, the gradations of density, and exposure which produced them for some particular fixed development treatment. I do not know if you wish me to define it more quantitatively or not.

Q43. No, I think not. Just give us some example of developments of a different character. A. Well, it is possible to compound developing solutions which will have a marked solvent action on the silver halide grains which compose the photographic emulsion. As a result of that solvent action, certain parts of these grains are dissolved away, and the resulting silver grain, after development, is smaller than it would have been otherwise. So that such a developer, we
431 normally refer to those as developers of the fine-grained type, or fine-grain character, produce imagines having relatively fine grain structure.

Now, other developers may be compounded so that they affect profoundly the color of the developed image. For instance, it is possible to obtain images which are distinctly yellowish or brownish or even reddish. By using different constituents in the developer, you can get bluish images. Moreover, there are certain things which can be added to a developer which will profoundly
432 change the shape of the characteristic curve, accentuating or suppressing the extent of the under-exposure region.

Q44. And those are examples of developments of a different character? A. Yes, they are.

Q45. Will you give me a specific example of a development process which abnormally and excessively emphasizes the density differences in the under-exposed region of photographic material? A. By extending the development time to a great value, for instance, 25 or 30 minues, it is possible to increase the density differences resulting from certain differences of exposure, in

the under-exposure region, or where the light has been relatively weak, where the exposures have been relatively low. If we do that, that is, give very long development times in an effort to enhance these differences in light and shade in that region, a fog usually develops to a very excessive extent, thus making the negative unsuitable for use.

Now, that fog can be prevented by the addition to the developer of some restraining agent, and one very commonly used is potassium bro- 434
mide, and by adding a large quantity of potassium bromide it is possible to extend the development time appreciably without getting any undue fog, and in that way enhance these differences of light and shade or of density in the under-exposure region, or on the toe of the so-called characteristic curve.

But when that is done the potassium bromide exerts a certain action on the character of the granular deposit of silver which is developed, causing the silver to be deposited in a more compact and finer grain structure. 435

Q46. It has appeared so far in this case that there is such a thing as a positive emulsion or stock, and negative emulsion or stock; what is the difference between the two? A. The term "negative emulsion or stock" is applied to emulsions which are very sensitive to light. In order to make them very sensitive to the light it is necessary to use fairly large-sized silver halide grains, and as a result of such materials, in addition to being very sensitive, they have fairly large or coarse-grain structures as compared

436 *Lloyd A. Jones—For Defendant—Direct.*

with other materials. This (the negative stock) is almost essential for making negatives in the studio where it is not possible to light the sets sufficiently to use slow or less sensitive materials; positive materials, on the other hand, are relatively insensitive to light, or as we say, slow, that is, of low speeds, but the grain structure is fine. They are normally materials of higher contrast, and are adapted to making prints because there is no lack of illumination or light. It is
437 easy to put a large lamp in a printing machine, and since they are fine-grained they give better results in the making of prints than would be obtained if we attempted to make prints on the negative materials, this grain structure being fine gives them the power of rendering fine detail to a much greater extent than the coarser grain materials.

Q47. Is that the reason that the defendant uses positive stock for its negative for sound? A. Yes, it is.

438 Q48. Because you can get finer lines on it for the sound lines? A. Yes, because it will render finer detail, and of course, the reproduction of sound, especially in the higher frequencies of sound, depends upon the rendition of very narrow lines.

Q49. In spite of the positive stock being slow, that is, comparatively slow, slower than the negative stock, you can use it for these fine lines which have to be photographed in a very short space of time, as I understand, you can use it because you have plenty of illumination for the sound, and that being the case, you can give a constantly good exposure for the sound, is that

it? A. Yes, with the equipment used it is possible to obtain adequate exposure.

Q50. You do not find anything in the patent in suit, do you, about using a different kind of stock for the sound negative film as compared with the picture negative film? A. No; I find no mention of that fact.

Q51. If the variable density sound record and picture record were both recorded on negative emulsion, would there be any advantage gained by developing one record with a developer of a 440
different character than that used for developing the other? A. The only advantage in that case would be the one mentioned in the patent, that is, of being able to develop the different picture scenes differently. If all of the picture scenes are correctly exposed, and if the sound record is correctly exposed, then the two could be satisfactorily given the same developing treatment.

Q52. As a matter of fact, does the disclosure of the patent in suit contemplate or does the object of the alleged invention as there stated re- 441
late to or having anything to do with sound and picture records in which the picture record, as well as the sound record, has been continuously normally exposed? A. No, it does not.

> Mr. Ward: I wish Mr. Neave would not lead the witness quite so much. I would prefer to hear what the witness has to say. He has been practically giving him the testimony right along.

Q53. Under what circumstances was machine development for the negative sound records taken

442 *Lloyd A. Jones—For Defendant—Direct.*

up in this country? A. Well, after the introduction of sound where the exposure of the sound record was normal or correct throughout its length, there was no need for differential treatment of the different parts as it previously existed in the case of pictures, and hence machine development was taken up as the best way of handling it.

Q54. And what is this machine development? A. In the case of machine development the film
443 to be developed is carred through a machine at a constant linear velocity. The film is looped over rollers and immersed in the developing tank, and since it is moved at a constant velocity every part of the film is in the tank for the same length of time, and therefore it receives the same development treatment, and as it passes from the development tank it is carried over additional rollers, through a rinsing bath, and into a fixing bath, and through a washing tank, and finally through a drying cabinet, where it is dried
444 under conditioned air and finally wound up on a reel. The process is a continuous one.

Q55. In that operation as you have described it, what opportunity is there to compensate for under-exposure or over-exposure by having over-development or under-development? A. There is no opportunity to compensate.

Q56. Are the picture negatives developed by a machine in that way now? A. Yes, they are.

Q57. What is it that has rendered that possible so that there is no over-exposure and under-exposure to be compensated for? A. Well, the conditions in the studios have been improved to the extent that it is possible for the cameraman to

445

expose all of their takes correctly. The better equipment for controlling the illumination in the studios has been developed. Methods for measuring the illumination have been devised. The cameramen have learned and been better educated to judge more precisely the amount of light that they have on their set and to adjust the settings of their cameras so that all the scenes are correctly exposed.

Q58. Before that modern practice was introduced, when you had over-exposure and under- 446
exposure, how was the negative developed? A. It was developed according to the so-called rack and tank method. According to that procedure the various scenes were separated from each other, and each one put on a separate rack; and these were then placed in a tank of developer or several tanks, and the operator would watch the course of the development. They were lifted out from time to time, and the image inspected, and by a judgment of the density and characteristics of that image, the operator decided when to remove it from the rack. 447

> The Court: You want a full record, I presume. I am familiar with the practice, but I do not know how far you want to go. I am familiar with this part.

Q59. Is the product which results from this practice of uniform exposure and machine development superior or is it inferior to the product previously obtained? A. It is superior to the old product, because while it is possible to correct to some extent for errors in exposure, as

448 *Lloyd A. Jones—For Defendant—Direct.*

under or over-developed negative is never as good as a correctly developed, correctly exposed negative.

Q60. Are the sound or picture records in the defendant's process both developed in the same type of machine? A. Yes, they are.

Q61. And in each of these machines, while subjecting the films to the developing process, the film travels through the machine at a uniform velocity, does it? A. Yes, this is the case.

449 Q62. Then upon what factors does the extent of development depend? A. It depends largely upon the time of development, and to quite an extent upon the concentration of the developing baths, its constitution; the temperature, and the agitation or the degree of stirring which is used.

Q63. It has appeared from one of the stipulations in the case just what developer is used by the defendant for the picture record, and the developer for the sound record; and it appears that the time of development for the picture negative is from 9 to 12 minutes, and the time of develop-
450 ment for the sound negative is from 4 to 5 minutes. Tell us why there is this difference in the times of development between two negatives. A. The negative developer is one of relatively low concentration. That is made intentionally low in order that the development time may be relatively long.

Moreover, negative film inherently is a slower developing material. It is desirable to have the time fairly long in order that the sulphite may assert its solvent action, and produce an image of relatively fine grain structure.

The positive film is inherently one which develops very rapidly. It is of fine grain material,

to begin with. On a fine grain material the solvent action is somewhat less than in the case of a coarse grained material. Since it is already a fine grain material it is not so important that the time of development, be long; and as a matter of practical convenience and expediency it is desirable to run it as fast as it is compatible with good results in order that the volume of film turned out by the machine may be relatively high.

Q64. Why is it that the time of development for the picture negative is given as from 9 to 12 452
minutes? Why is it not just 10 minutes? Why is there leeway there? A. Well, there are certain unavoidable variations, manufacturing variations in the manufacture of a photographic material; and one of those variations is the rate at which it develops.

Moreover, that rate at which a photographic film develops varies somewhat with the age of the material. If it is very fresh it may have one rate of development, and if it has been kept for some time after manufacture it may have a slightly different rate of development. 453

Moreover, the rate of development depends very profoundly upon the temperature, and while the temperature of the bath is controlled with great care, very small variations in temperature may affect the development time appreciably, and in order to compensate for these practical things it is necessary to have some tolerance in the development time.

Q66. Those reasons are also the reasons for the tolerance of between 4 and 5 minutes in the development of the sound negative? A. Yes, that is true.

454 *Lloyd A. Jones—For Defendant—Direct.*

Q67. These two developers that are stated in the record as being used by the defendant, one for the picture record and the other for the sound record, seem to contain, each of them, the same ingredients except that the developer for the sound record has in it some boric acid that is not present in the developer for the picture record. Why is that? A. The boric acid is added simply as a means of controlling the alkalinity of the developer.

455 Q68. The what? A. The rate at which the development proceeds depends upon the alkalinity of the solution.

In the case of the sound formula it is being used to develop a material which has an inherently high rate of development. It is desirable, in order to prevent the developing too rapidly the boric acid be added to reduce the alkalinity of the developer.

The alkali in a developer is an accelerator developing solution without alkali does not operate
456 satisfactorily; and the alkali is added to accelerate that action.

There is one other function which the boric acid performs. As the developer does the work in reducing silver halide to silver, the alkalinity tends to decrease, that is, the alkali is used up.

In the case of certain alkalies, they are rendered completely disassociated in the solution. All of that alkalinity is available, or most of it is available, instantly. They develop very rapidly, but they soon lose their power to develop because of this loss of alkalinity.

In the case of these two developers the borax

is the active alkali, and the borax is a relatively weak alkali. Moreover, it is not completely dissociated, and hence becomes available only as it is needed. We say that it makes a buffered solution, which simply means that it will hold its reducing power constant over a long period.

Now, that is very desirable, especially in the case of machine development, where it is desired to have the developer maintain a fixed power to do work over a long period of time in order to get a high uniformity of results. The addition of 458
boric acid increases that buffer action to a certain extent, so that it given a somewhat better controlled developer. It has no effect on the grain structure, and it has no effect upon the shape of the characteristic curve.

Q69. These two developers, the one used for the sound negative, and the other for the picture negative, while having in them the same chemicals, except the boric acid is added for the sound record, they are used in different proportions in the different developers; why is that? A. It is merely a question of practice. The adjustment 459
is made simply to control the rate at which development proceeds. In the case of the sound developer there is a larger proportion of the reducing agent used merely to give reserve power to do work.

Q70. Are the two developments obtained by the defendant with these different developers on the two negatives of the same character or of a different character? A. Developments of the same character.

Q71. What do you mean by that? Is it with reference to the ingredients of the developers

460 *Lloyd A. Jones—For Defendant—Direct.*

and their composition why the development is of the same character in both instances? A. Well, both developers contain the same components, with the exception of the boric acid, which, as I have explained, performs a function merely in controlling alkalinity and in buffering the solution.

Q72. Does each of the developers produce a deposit of the same granular characteristic or different granular characteristics? A. They are
461 practically identical.

Q73. The shape of the characteristic curve with each compares how? A. They are identical at equal contrasts.

Q74. What advantage, if any, could be gained by giving defendant's positive emulsion sound record a different character of development from that used for the negative emulsion picture record? Would there be an advantage, and if so, what? A. There would be no advantage in using different characters of development.

462 Q75. In the defendant's process are the sound and picture records developed to substantially the same or to different contrasts or gamma, using the developers and times of development which have been given in the stipulation? A. They are developed to substantially the same contrasts.

Q76. Is it the general practice or the unusual practice in light valve or straight line recording to develop the two records substantially to the same gamma or contrast? A. It is the general practice to develop to substantially the same contrast.

Q77. Professor Ballard seems to have pointed out that there is a 20 per cent. difference in the over-all gamma of sound and picture records. I would like to ask you whether a 20 per cent. variation of the over-all gamma in the picture record is an appreciable or an inappreciable amount? A. It is inappreciable. It is possible that it is detectable under the most favorable conditions, such, for instance, as if the two pictures were projected side by side in a laboratory, but certainly under practical conditions of pro- 464
jection in the theatre, the difference is inappreciable.

Q78. Is the 20 per cent. variation of the over-all gamma of the sound record appreciable or inappreciable? A. It is inappreciable. A variation as low as that introduces an imperceptible amount of harmonics into the sound as reproduced. The difference cannot be detected by most individuals. In fact, it is only measurable with precision instruments.

Q79. Can one develop the picture negative 465
satisfactorily in defendant's sound negative developer and also the sound negative satisfactorily in defendant's picture developer? A. Yes, that can be done.

Q80. How about the time—the times? A. Well, naturally, the time of the development will have to be adjusted to give the desired contrast in the two cases.

Q81. In the defendant's process what are the so-called advantages of recording the sound on a film separate from that on which the picture is recorded? A. It makes it possible to use a positive emulsion with its high resolving power, and

therefore obtain better rendition of high frequencies.

Q82. Now, will you tell us just what resolving power is? I always have difficulty in remembering my definitions. A. Well, resolving power may be described qualitatively as that characteristic of a photographic material which makes it capable of rendering very fine details. It is expressed quantitatively in terms of the number
467 of lines per millimeter which can be rendered thereon as distinguishable.

Q83. What is the resolving power of negative emulsion in the number of lines per millimeter? A. It is about 50 lines per millimeter.

Q84. And of the positive emulsion? A. About 75 to 80.

Q85. What advantage do you get by having more lines to the millimeter? A. Well, in the recording of sound it makes it possible to render the higher frequencies more satisfactory with greater naturalness, and less loss of loudness
468 or volume. It makes the sound as rendered under those conditions more natural.

Q86. Leaving for a moment this question of how many lines you can get on per millimeter, tell me what this photograph shows (handing to witness), or series of photographs on one chart? A. This is a series of photomicrographs. The upper two are made on Eastman positive film; and the one at the left, designated as "3" was developed in the defendant's picture formula.

The one at the right was developed in the defendant's sound formula.

This represents a recording of an 8,000 cycle per second constant frequency tone. An exam-

ination or a comparison of the two shows that the results are identical. The two photomicrographs at the bottom of the chart are made on Eastman supersensitive panchromatic motion picture negative film, the one at the left being developed in the defendant's picture formula, and the one at the right in the defendant's sound formula.

A comparison of the two again shows that the results are identical.

Mr. Neave: I offer that sheet in evi- 470
dence.

(Marked Defendant's Exhibit D in evidence.)

Q87. I show you another sheet that has on it two pictures. Will you tell me what that is? A. These tests were made to demonstrate that pictures of the same quality can be obtained by developing in the defendant's sound formula and picture formula. In making these, a master positive from a good motion picture negative was used as the original. Prints were made, contact 471
prints, from the master positive were made on the negative film. These were developed, the top one was developed in the defendant's picture formula, and the lower one in the defendant's sound formula. Times of development were adjusted to give the same contrast of gamma. From the negatives, from the resulting negatives obtained in that manner, enlargements were made under identical conditions on the same kind of bromide paper, and the development conditions being identical in the two cases. They are shown to demonstrate that the two formulae gave the same quality.

472 *Lloyd A. Jones—For Defendant—Direct.*

Mr. Neave: We offer that sheet in evidence.

(Marked Defendant's Exhibit E in evidence.)

Q88. Have you the negatives from which these photographs on Defendant's Exhibit D were made? A. No, I have not. They are in Rochester. They can be obtained.

Q89. You could have them here tomorrow. Can you telephone up for them? A. I think probably
473 we could have them here tomorrow.

Mr. Ward: I would also like the negatives from which Exhibit E was obtained.

Q90. Will you try to get those also? A. Those are the pictures?

Q91. Yes. A. Yes, I think I can have them here tomorrow.

Q92. If you will remember as soon as court closes to telephone down for them.

474 Mr. Ward: Your Honor, may I reserve an objection to the Exhibits D and E, subject to the production of the negatives from which they were made?

The Court: All right.

Q93. I hand you another sheet which has some curves on it. What do they indicate? A. These curves show the frequency characteristic of the negative and positive emulsion. They were made by recording various frequencies of constant pitch—of constant frequency on the negative emulsion—and on positive emulsion; and then

475

measuring the volume loss. The various frequencies, the one marked "positive emulsion" shows the amount of loss as frequency increases; and the one marked "negative emulsion" shows the amount of loss of the recordings made on the negative emulsion. The frequencies are plotted horizontally as abscissa values, and the ordinate scale is in decibels. The decibel being a unit in which sound intensity is expressed.

It will be noted, for instance, that at any frequency we may select, for instance, 6,500 cycles, that there are three units, three decibels loss for 476
positive film; while for that same frequency the loss for the negative emulsion is about 9½ decibels—pardon me; that is incorrect. The loss at 6,500 cycles on positive emulsion is 3¼ decibels; and the loss at 6,500 cycles for negative emulsion is about 9¼. The difference is 6 decibels, which means that the sound intensity as recorded on negative film is one one-quarter as great as that recorded on positive film at that frequency.

Mr. Neave: I offer that chart in evidence.

477

Mr. Ward: Do you propose to offer the data from which the witness made those charts in evidence?

Q94. Have you the data from which you made those charts or on which those charts were made? A. No, I did not make those measurements. Those measurements were furnished to me by Dr. Wente.

Q95. Have you made yourself measurements of this same character? A. Yes, we have made many measurements of the same character in the laboratory in Rochester.

478 *Lloyd A. Jones—For Defendant—Direct.*

Q96. Have you made some of those measurements yourself A. I have not made them personally. Men under my direction have made them.

Q97. And have you drawn curves to those measurements? A. Yes.

Q98. Is this curve that I have just now offered in evidence characteristic—I don't like the word "characteristic"—illustrative? A. Yes.

Q99. Of the various curves that you have made? A. Yes.

Q100. Although they might vary a little bit?

479 A. It is illustrative. I am quite unable to say that they actually may be quantitative, but they are of the same order, of the same general type.

Mr. Neave: That is what it is introduced for. It does not prove extreme accuracy.

Mr. Ward: Will you state specifically what it is introduced for?

Mr. Neave: To show the characteristics generally of positive and negative emulsion, and to indicate the reason the defendant uses the positive emulsion for the sound record.

(Marked Defendant's Exhibit F in evidence.)

Q101. Will you define what is meant by combination or composite printing? A. The term is applied to the making on a single piece of photographic sensitive material prints or impressions from two or more separate negatives.

The prints may be made side by side on such material, or they may be made in superposition in such material, or they may be made in opposite faces of such material. The general word

combination printing covers that entire class of operations.

Q102. You previously testified that the art of photography is quite old, and you referred to certain outstanding developments in the early days of photography. How old is the art of composite printing? I do not care exactly. A. Well, it is almost as old as photography. It is very old. It has been practiced for many, many years.

Mr. Neave: It is agreed that the En- 482
cyclopaedic Dictionary of Photography by Woodbury, published by the Scovill & Adams Company of New York in 1896, contains the following definition:

"COMBINATION PRINTING: A method of printing in which the whole or portions of two or more negatives are combined."

It is agreed that Wilson's Cyclopaedic Photography, published by Edward L. Wilson in New York in 1894, contains the 483
following definition of Combination-Printing:

"A mode of printing by which the positive is obtained by the help of two or more negatives. In printing from the first negative, those places which are to be obtained through the second, are stopped out, and when printing from the second negative, the parts already printed are protected. It is made use of when a portrait is to have a different background or clouds are required in a

landscape with white sky, etc. The simplest form of combination-printing is the combining of a separate cloud negative with a cloudless landscape negative, to produce a print of the landscape with cloud effects as if the whole had been secured with one exposure. Similarly, groups of persons can be combined in one print from separate negatives of each person, a suitable background be-
485 ing required as the basis; or figures may be inserted in landscapes as required, etc. The usual method of procedure is to carefully block out in the origial negative the space required for the insertion of the figure, clouds, etc., and having obtained a print in this way, to print in the detail from a second negative in which only the figure (or clouds) is allowed to impression the print. Care and patience are required for this work, by which beautiful and in-
486 teresting results may be obtained."

It is agreed that in Cassell's Cyclopaedia of Photography, edited by Bernard E. Jones, published by Cassell & Company, Ltd., in 1912, it contains the following under the head of "Combination Printing":

"The art of making a print by the use of two or more negatives. The simplest form of combination printing is the printing of a cloud into a landscape, but combination printing proper is the art of adding trees, figures or other ob-

jects to a picture, as practiced by Rejlander, Robinson, and other past masters of the art. Combination printing had its origin in 1855, when Berwick and Annan, of Glasgow, exhibited a picture printed from two different negatives—a figure in a landscape. In 1858 Sarony patented an improved process which consisted of taking up the different portions of the collodion film from the glass of one or more negatives and 488 laying them down upon another glass in their proper relative positions and printing from it. Rejlander, however, was the first to draw attention to the possibilities of combination printing, and in 1857 he used thirty negatives to produce a single picture ('The Two Ways of Life'), which he exhibited at the Manchester Exhibition of that year; all except the part required was blocked out on each negative, all the negatives were then laid in turn upon sensitive paper 489 and printed, the remainder of the paper being covered with black velvet. In the following year (1858) Robinson produced the first of his famous series of combination prints, 'Fading Away', for which five negatives were used, and in 1863, 'Bringing Home the May' (nine negatives); this type of combination printing then became the craze.

"The methods fully described under 'Clouds, Printing in', may be adopted in some forms of combination printing, but in others, such as the addition of a fig-

ure to a landscape, or the substitution of a suitable background for an unsuitable in a figure subject, a different method will be more fitting (see, for example 'Backgrounds, Printing in'). In many cases, however, the pencil and brush marks described under the heading first given above will be found useful in securing registration.

"For combining portions of two or more negatives to form one print, whether the object is to print a new background to a figure or to combine in one picture selected parts of two or three landscapes, etc., the method described under the heading, 'Backgrounds, Printing in', or some modification of it, can be adopted. In some respects the method about to be described has points of advantage compared with that given in the reference last mentioned. A silver print is taken from the figure negative, and the figure cut out very carefully with a sharp knife. Both parts of the print must be kept to form masks. First, the portion from which the figure was cut should be attached to the glass side of the figure negative, and then the two negatives should be held together vertically with their edges resting on the table and the corners accurately coinciding, or preferably placed on a retouching desk with their corners together. The figure negative must be underneath and the glass side of each negative towards the worker. The figure that was

cut from the rough print must now be attached to the glass side of the background negative in such a manner that it corresponds in position accurately with the opening in the mask on the figure negative, this opening being easily seen for obtaining a correct adjustment by this method of holding the two plates.

"In printing, it is immaterial which negative is used first. Either negative is placed in the printing frame with one 494
edge in close contact with the woodwork of the frame—preferably the edge that was resting on the table when the masks were adjusted on the negatives. In the diagram the edge AB is shown pressed closely against the frame, the corner being pressed right into that of the frame. The printing paper need not be cut accurately to fit the negative, but it must touch the same side and the same corner of the frame as the negative. The paper is indicated by dotted 495
lines. When this part of the printing is finished, the print and the negative are removed from the frame, and the second negative is placed in the frame with its corresponding side and corner pressed closely against the side and corner A. B."

It is also agreed that a book by Konig, published in London by Dawbarn & Ward, Ltd., with a preface dated 1906, contains the following, on page 36: This relates to the title of the book, "Natural Color Photography."

"When one has decided to work with only one kind of plate, should all three exposures be made on one long plate, or should three separate plates of the same kind, be used? The former plan presents a certain convenience for the expert; but so long as one is not absolutely certain of his factors, it will often be necessary to develop one or other of the individual exposures somewhat longer,
497 or harder, or possibly softer. Such individual treatment of each exposure is obviously impossible when all three exposures are made on one plate."

By Mr. Neave:

Q103. Does the process of the patent in suit involve any photographic operations which are not involved in the ordinary art of composite printing, and if it does involve some additional operations, tell us what they are? A. It involves nothing other than that known in the art of com-
498 posite printing.

Q104. How about in composite printing using and subjecting the two negatives to different lengths of development? Was that done or was it not done? A. Very common.

Q105. Did you do that composite printing yourself prior to April, 1921? A. Yes, I have often made prints, printing in clouds into landscapes without the clouds and other types of composite printing. It was commonly used in pictorial photography.

Q106. How early did you do that? How far back did you do that work yourself? A. Oh, I imagine about in 1900.

Q107. And the Eastman Company, did it have any experience, so far as you know, with composite printing prior to April, 1921? A. Well, of course, the art and practice of composite printing has been so general that the Kodak Company has made materials which have been used for that purpose, in many cases special materials for the practice of combination printing.

Q108. Now, will you state the steps involved in making composite prints such as you did them prior to 1921, and such as Eastman did them 500 prior to 1921, beginning with the making of the separate records? A. Well, two or more negatives are exposed, either on the same or different objects. These exposed negative materials are then developed separately in such a way as to give images of the character required for the subsequent operation of making the combination print. These are then printed together on a single piece of photographic material. They may be either adjacent, juxta-posed, or superposed, in register, on the same face or on opposite faces, as the case may be. There are any number 501 of possibilities of combining the negatives in making combination printings.

Mr. Ward: May I ask a question in regard to this printing of composite prints?

Mr. Neave: Surely. Go ahead.

By Mr. Ward:

Q109. It is my understanding that all of this testimony you are giving in regard to this printing of composite prints relates entirely to pictures, has nothing to do with sound pictures? A. That is the case.

502 *Lloyd A. Jones—For Defendant—Direct.*

By Mr. Neave:

Q110. It does not make any difference if they are separately developed, this composite printing? A. Yes, they were.

Q111. Each negative is clearly appropriate to itself? A. Yes.

Mr. Neave: I offer in evidence a volume entitled, "Defendant's Book of Prior
503 Patents", containing the following patents:

UNITED STATES PATENTS.

125,522	Bendann, *et al.*	April	9, 1872
606,993	Jenkins	July	5, 1898
1,186,717	Walker	June	13, 1916
1,254,684	Greensfelder	Jan.	29, 1918
1,260,337	Craig	March	26, 1918
504 1,286,383	Messter	Dec.	3, 1920
1,335,651	Bullis	March	30, 1920
1,489,314	DeForest	April	8, 1924
	(Filed July 16, 1921.)		

BRITISH PATENTS.

21,467	Rossi	1909
23,620	Rosenberg	1911
6,727	Downing	1913
18,163	Kindermann	1913
115,942	Pedersen	1918

GERMAN PATENTS.

275,551 (and translation) Thornton 1914
279,598 (and translation) Reimer 1914

FRENCH PATENTS.

448,757 (and translation) MacCarty 1913

(Marked Defendant's Exhibit G in evidence.)

506

By Mr. Neave:

Q112. Will you please refer to the Bullis patent No. 1,335,651, which is item No. 7 in the Book of Patents, which has just been offered in evidence—

Mr. Neave: I will state that those patents in the volume not set up in the answer, are not relied upon as anticipation, but simply to show the state of the art.

Mr. Ward: May I state that the patents 507
not set up in the answer, as I understand it, even though they are contained in this volume are the British patent to Rossi, No. 21,467 of 1909, Rosenberg British patent, 23,620 of 1911, and the Thornton German patent, 275,551 of 1914, and the MacCarty French patent, 448,757 of 1913.

The Court: They are to show the state of the art, and not for anticipation.

Q113. Mr. Jones, referring to this Bullis patent, which is entitled, "Talking Picture Appa-

508 *Lloyd A. Jones—For Defendant—Direct.*

ratus," what does this patent disclose concerning the simultaneous photographic recording of sound and picture records on separate films? A. It discloses that the sound and picture records are recorded simultaneously on separate films.

Q114. That is, on separate negatives? A. Yes.

Mr. Neave: Your Honor will note what is stated at page 1, line 12 of the patent to Bullis.

509

Q115. Now, does this Bullis patent or does it not contemplate giving the picture and the sound negative the length and character of development and treatment which may be appropriate for each? A. It contemplates giving them the separate and appropriate treatments.

Q116. And does the patent also state that the same emulsion may be used for both sound and picture? A. Yes, that is the case, it does.

Q117. And there may be the same emulsion or different emulsions? A. Yes, either the same
510 or different emulsions.

Mr. Neave: That, your Honor, is on page 2, line 58:

"The picture film 10 and sound film 11 are made separate and distinct from each other and may be treated with the same emulsion, or with different emulsions, as found necessary to obtain the best results."

Q118. What is Bullis' method of synchronism between the picture and the sound mechanism in

recording? A. They are driven through the camera during the recording of the sound and picture by a sprocket, as shown in Fig. 7, which is made so that it will carry both the film on which the sound is being recorded and the film on which the picture is being recorded. They must necessarily stay in synchronism.

Q119. Then there is some kind of a numbering strip used. What was that for? A. Yes, as shown in Fig. 2, No. 13, a numbering strip is employed which carries a series of numbers or 512
characteristic marks that are impressed upon the sound and picture films during exposure and on subsequent development become visible.

Q120. This patent states that the sound record and the picture record may be handled separately and developed, and then it says at lines 41 to 43 on page 1: "And subsequently joined together so as to produce a single film if such is desired." What do those lines that I quoted mean to you? A. Well, it means that he contemplates either uniting these films to form a single film, a single sound and picture positive, or using them sepa- 513
rately.

Q121. What specific methods of uniting are shown in this patent for reproducing? A. He mentions pasting or cementing as one method.

Q122. And that is the specific thing shown in his drawings? A. No; the specific thing shown in the drawing is that the two films are run over the same sprocket, which contains three rows of sprocket teeth, and this sprocket thus carries on two films in the united and synchronous position.

Q123. So that the two films there act as a single film in reproducing? A. So far as reproducing, yes.

514 *Lloyd A. Jones—For Defendant—Direct.*

Q124. Will you refer to the Walker patent, which is item No. 3 in this book of patents? What does it disclose as to the printing of the sound record and the picture record onto a single positive? A. It discloses that the sound and picture records are printed on the same positive film strip.

Q125. Simultaneously or consecutively? A. Consecutively.

Q126. And is the positive film which is thus printed with the impression of the two negative
515 films one of standard width? A. Yes, it is.

Q127. And that is shown in Fig. 8 of the patent, is it, on sheet 3 and there marked— A. Yes, that is shown in Fig. 8, the sound track being designated as 31A.

Q128. And the recording apparatus of this patent, was that a combined camera and sound recorder, or are there two different instruments for each work? A. No; as shown in Fig. 1, the recording equipment is a combined picture and sound recorder.

516 Q129. And is the sound recording of the variable density type or of the variable area type? A. It is of the variable density type.

Q130. What is shown in Fig. 6, just generally? A. Fig. 6 shows a combined sound and picture reproducing equipment.

Q131. And what does Fig. 7 show? A. Fig. 7 shows the printing machine or device which is used in printing the sound and picture records carried on the negative onto the final positive.

Q132. What is the functional difference, if any, between printing consecutively the picture record and the sound record on the single positive

films as disclosed in this patent, and printing consecutively the separate sound and picture records on a single positive film as disclosed in the patent in suit? A. There is no functional difference.

Q133. And whatever difference there is, is what? A. It is merely that in the case of the patent in suit, the sound and picture record are printed from separate negatives, and in this case from a single negative.

Q134. Now, will you turn to the Craig patent, 518
which is item No. 5 in this book of patents? What does it show as to the simultaneous recording of sound and picture records on separate films? A. This patent discloses the simultaneoue recording of pictures and sound on separate films.

Q135. And that is simultaneous, is it? A. That is simultaneous.

Mr. Neave: Now, your Honor, this patent discloses the printing of a separate sound and picture record on the same positive, this being stated on page 4, lines 113 519
to 120, where it is said:

> "It will be noted from what has gone before that so far the negative of the sound record and the negative of the picture record have been made upon separate strips of film. It is necessary, therefore, that these two negatives should be photographically printed upon one film or upon opposite sides thereof."

Q136. Now, what is your understanding of this last sentence that I have quoted? A. It indi-

520 *Lloyd A. Jones—For Defendant—Direct.*

cates that Craig contemplated printing the sound and picture records onto the same film and either upon the same faces or upon opposite faces.

Q137. Does Craig show in any of his figures the two records printed on the same side of a single positive? A. In Fig. 8 he shows two sound records printed on the same face of a single positive film.

Q138. Alongside of each other? A. Alongside of each other.

521 Q139. There is a plurality of sound records upon one side of the film? A. Yes, there are two, and the patent indicates that he might use more.

Q140. What advantage would there be in having two sound records on the same film? A. It would make it possible to use two loud speakers in reproducing, the records having been made from microphones placed at different parts of the set or stage.

Q141. Now, what is there in the Craig patent with reference to more than two records being
522 recorded on the same film? A. Well, it states that more than two may be recorded if desired, a plurality of records may be recorded.

Mr. Neave: Your Honor may note, as a matter of interest, that referring to Fig. 7, Craig states on page 2 at line 106 that: "Fig. 7 is a view of a composite film showing the position of the sound records with relation to the pictures." And also in a number of the claims a composite picture and sound recording film is referred to.

Q142. Do you agree, Mr. Jones, that this that is spoken of in the Craig patent is composite printing? A. Yes, it certainly is.

Q143. Now, Craig also specifies, does he not, that he may print a sound record or records on one side of the film and his picture record on the other side? A. Yes, that is the case.

Q144. What is gained by that? A. Well, there are certain advantages to be gained by such procedure. In the first place, it eliminates the necessity of using up some of the space on the picture 524
side of the film, thus making it necessary to reduce the size of the pictures; it also enables him to use a wider film sound record than would be feasible otherwise.

Q145. On the defendant's film in this case, the film is of standard width? A. Yes.

Q146. And the picture part is cut down from what it used to be, it is made narrower? A. Yes, that is the case.

Q147. So as to permit the sound being there? A. Yes.

Q148. Is there any advantage in having the 525
full width, such as Craig has for his picture and a full width for his sound? A. Yes, there are some advantages in that procedure. By using the full space for the picture, it is not necessary to use such high magnification in projection, that is an advantage, and the wider sound track has some advantages.

Q149. Does it appear from this Craig patent whether the sound record and the picture record are each recorded on negative emulsions, or are the emulsions of a different character for the two? I think that is referred to on page 4, line 56? A. Yes, the patent states definitely that the

526 *Lloyd A. Jones—For Defendant—Direct.*

records are taken on an ordinary negative motion picture film.

Q150. What was the practice in the motion picture industry in 1913 as to the development by means of the rack and tank method of different sections or takes of the picture record to correct under and over exposure? A. It was customary to develop those takes differently to compensate for any errors of exposure that may have been made in the photographing of the dif-
527 ferent scenes.

Q151. Was it necessary at that time to make such corrections in the picture record? A. Yes, it was.

Q152. Do you happen to know who owns this Craig patent? A. The Eastman Kodak Company.

Q153. What does Craig disclose in order to obtain the sound record on one side of the film overlying the picture record on the other side without having one record interfere with the other record in the reproduction? A. He discloses a method for printing the sound record so that
528 it will be reproduced by the use of invisible light or invisible radiation. There is radiation of wave lengths shorter than the visible and also longer than the visible region, which, of course, has no effect upon the eye, and therefore would not interfere with the quality of the picture. And by forming his sound record in some material which has absorption in one of these invisible regions, he is then able to modulate that radiation and cause a reproduction of the sound without interfering with the image thrown on the picture screen.

Q154. How does he print the two negatives on this positive, one on one side and one on the

other side of the positive? A. He prints them consecutively, using a material which is double coated, that is, has a sensitive coating on both sides. He prints the picture on one side carrying an ordinary positive emulsion, and on the other side, he prints the sound which carries a special coating, giving him the sound modulation in invisible radiation.

Q155. Why do not those two interfere with each other? Are the emulsions on both sides of the positive all the time? A. Well, the picture 530
can be finished first, and then after that, the other side of the positive film can be coated and sensitized and the operation of putting the sound on that carried out later.

> Mr. Neave: Your Honor, in the prosecution of the application for the patent in suit, the patentees apparently endeavored to distinguish this Craig patent from the alleged invention in suit, stating that Craig's only object in making the two negatives on separate films was apparently convenience, in that he wanted to print on 531
> opposite sides of a positive film, and it would be easier to do that when the sound and picture records were on separate films.

Q156. Mr. Jones, is that statement that I have just quoted justified in your opinion or not? A. No, it is not.

Q157. Why not? A. Because Craig's chief object in doing as disclosed in this patent is to obtain the records so they do not interfere with each other, preserving the full width of the film for the picture, and obtaining a wide sound record.

532 *Lloyd A. Jones—For Defendant—Direct.*

Q158. Do you know anyone else beside Craig who has done work along those same lines in employing a sound record which will transmit ordinary light but which will obstruct lights which are beyond the visible spectrum? A. Yes, the Gaumont people in France have disclosed such a method. It was described in the British Journal of Photography, March 15, 1929, and they used the ultra-violet region, rather than the infra-red, as proposed by Craig. They proposed
533 using a coating on the back of the positive film which can be sensitized by the well known bichromate process, and printing and developing in the usual manner for such a sensitive coating which will obstruct the ultra violet radiation. Then they use the ultra violet light radiation which is invisible to the eye for reproducing the sound.

Mr. Ward: I would like to know whether Gaumont is set up as anticipation. It is not pleaded.

Mr. Neave: That is all I am going to
534 say about that. He is just mentioning that as an illustration.

Mr. Ward: Are you putting it in to show it is possible to have a picture record and a sound record on opposite sides? Is that all you are putting it in for?

Mr. Neave: Yes, if it may be desirable.

Mr. Ward: Not as an anticipation?

Mr. Neave: No.

Mr. Ward: Then it has nothing to do with the suit.

Mr. Neave: It has something to do with the suit but not as anticipation.

Q159. What is the width of the sound track on the sound record that is used on Defendant's film, about 100 mils.? A. Approximately.

Q160. What advantage is there in having a sound record that is wider than that? A. By using a record wider than the present standard, it is possible to average up or integrate certain of the granular structure which is in the sound record, and therefore minimize the disturbance which is known as ground noise. This disturbance arises from several causes, one of which 536
is the grainy or granular structure of the image, and others, scratches and various imperfections on the surfaces of the film, namely, the sound track. Now, if the record is relatively narrow, a small irregularity produces a large percentage effect when it passes the scanning line or scanning slit of the reproducer. If that scanning line or slit is longer, the same size of disturbance produces a smaller percentage effect upon the radiation transmitted by the slit, and falling upon the photo-electric cell, and thus a wider sound track tends to minimize many of these disturbances, 537
giving a quieter and better reproduction.

Q161. In the sound and picture records of the films such as the defendant is using it appears that the sound record is photographed on the film in a track which runs along parallel with the picture record on the same side of the film. Now, were there other means of impressing a sound record on the film running parallel with the picture record, and will you look at the Pedersen patent, and tell us what that is, by what manner they impress the sound record on the film? That is item No. 13, British Pedersen patent? A. British Perdersen patent.

538 *Lloyd A. Jones—For Defendant—Direct.*

Q162. What is the character of the sound record? A. In the case of the Pedersen patent the sound record was recorded in the form of a wavy line. That was accomplished by actuating a small diaphragm carrying a small aperture. This diaphragm is actuated by the currents coming from the receiving or the pick-up device, so that it moved laterally, while the film was traveling through the recorder. This caused the exposure of the film in the form of a wavy line, depend-
539 ing upon the sound which was being recorded. And after development, of course that came out as a black wavy line on the negative.

Q163. And that sound was recorded simultaneously with the recording of the pictures by photographic methods? A. Yes, that was recorded simultaneously.

Q164. And that sound wiggle ran along down the edge of the film as our sound record does in the defendant's? A. Yes, in this case.

Q165. In this Pedersen record, after the sound record has been transferred to the metal strip or
540 thin metal band, are the sound and picture records on separate bands, or the same band? A. They are on separate bands.

Q166. Are those separate records printed on the same positive film? A. Yes, they are.

Q167. Is the negative picture record developed alone in a manner appropriate to it? A. No; the negative picture record is developed in the usual manner, and the sound record, after transference, after having been printed on the thin metal strip, is developed by a special technique of a photo mechanical nature, the bichromated fish glue process.

Q168. Two different kinds of treatment for the two records? A. Yes.

Q169. Are these two records printed consecutively or simultaneously on the same positive film? A. They are printed consecutively.

Q170. Is it done on two positive films of different character or of the same character? A. It is all of the same character in the positive film.

Q171. Do you know whether records of this type such as the Pedersen patent have been ap- 542
plied in motion picture films practically? A. Yes, that process has been developed to quite an extent, and some very fair quality of records have been made in similar manner.

Q172. Will you tell me whether or not the cellulose base of positive film is a suitable medium on which to print a sound record of the phonographic type such as Pedersen? A. Yes, it is a very suitable material for use in the embossing type of printing which is required in making this type of photographic record.

Q173. Was the cellulose base of this type in 543
general use in 1917 when the Pedersen application was filed, or did it come into use only later? A. No, that is the same material that has been used the last 30 years in making phtographic film.

Q174. Have disc phonograph records been made on this cellulose base? A. Yes, they have; quite recently some very excellent records have been made in this manner in the Bell Telephone Laboratories.

Q175. Now, will you turn to the Greensfelder patent, item No. 4 in the book, and tell us what

544 *Lloyd A. Jones—For Defendant—Direct.*

that record is and how it is made? A. Greensfelder makes a sound record by photographing sound marks on a negative film. These marks are made by the actuation electromagnetically of diaphragms which cause the light to act upon the film from time to time.

Q176. The picture record is taken on one negative, is it not? A. The pictures are recorded on one strip of negative film, and the sound records are recorded on another length of negative film
545 separately.

Q177. Then they are both printed on the same positive? A. After development they are printed onto the same positive film.

Q178. Tell us briefly how the sounds are reproduced from the sound marks of the Greensfelder patent? A. After printing the sound marks which, of course, on the negative are narrow black lines, and are represented, as I said, on the positive film by narrow transparent lines, the film in going through the reproducing equipment controls the light which passes through a series
546 of small diaphragms, and when one of these transparent marks comes into proper position the light from a suitable source falls upon a selenium cell which then actuates electromagnetically the sound-reproducing mechanism on each.

Q179. In Fig. 3 of this Greensfelder patent, the picture record is easily seen and the sound record is those vertical lines in the space between the two pictures? A. Yes; in Fig. 3, the sound record lines are indicated as 3 on the figure. They lie between consecutive pictures.

Q180. Now, what is the difference, as compared

with that, and what is shown in Fig. 5? It looks as though the two records were parallel there side by side. A. In Fig. 5, he produces the final sound and picture print on double width film. The picture sequence is shown at the right hand of the Fig. 3 between the adjacent rows of perforations and at the left is the sound record. In this case the transparent lines are elongated and the whole record lies side by side with the picture record.

Q181. And Fig. 5 shows one positive film, does 548
it, of double width? A. Yes, that is the case.

Q182. And how do the negatives get onto that film? A. The picture negative is printed onto this film in one operation, and then later the sound records are printed on from its own sound negative; consecutive operations.

Q183. Here in this Greensfelder patent is the picture record and the sound record on the same side of the film, or are they on different sides of the film? A. They are on the same side in this case.

Q184. By "side" I mean "face." A. Yes, on 549
the same face.

Q185. I think you have said that in this Greensfelder patent there are separate negatives, one for the sound and one for the picture. Are they developed separately before printing? A. Yes, they are developed separately.

Q186. Let me ask you, Mr. Jones, could any advantage be obtained by developing the sound and picture records of the Greensfelder patent differently? A. Yes, there could be certain advantages obtained by doing that. The sound marks, of course, should be developed to a high

density, but at the same time not sufficiently high to cause any undue spreading of the image. If an exposed negative is forced in developing, fine lines tend to become wider. It might be very undesirable in the case of a record of this kind, so the sound negative record should have a proper development treatment.

Mr. Neave: Your Honor, during the prosecution of the application here in suit, the patentee stated, with reference to this
551 Greensfelder patent, that in Greensfelder, "there is no need of developing the sound marks and pictures in any different way from each other, because of the fact that his sound marks are composed of entirely translucent rectangles having no gradations which must be properly brought out in the developing."

Q187. Do you agree with that quoted statement that I have just read? A. No, I do not.

Q188. Why not? A. At that time, in the making of pictures, it was very customary to en-
552 counter improper exposure, and to compensate for this incorrect exposure, it was customarily to develop different parts, different takes, different scenes to different extents. For instance, a scene which had received under exposure would be forced in development in order to bring up the density difference to the desired value.

Now, if the sound record, as made by this method, were attached to such a picture record, and therefore had to receive the same development, it is almost certain that this forcing in development would cause a broadening of these lines, and that would be undesirable.

Q189. Now, will you refer to the British Kindermann patent of 1913— Will you tell us briefly what that discloses? A. This patent discloses the simultaneous recording of pictures and sound on a photographic material to the edge of which was attached a thin metal strip, coated with wax, and an engraving tool or stylus was actuated by the sound-pick-up mechanism so as to cut a wavy line in this wax coating, thus exposing the metal of the strip, and after recording the sound picture, the sound and picture records were sep- 554
arated by removing the metal strip from the picture negative film. The two were then developed separately, and in that way records of the sound and the picture were obtained.

Q190. Does Kindermann separate the sound and picture records? A. Yes, as I have stated, after exposure, the part of the record carrying the sound—the part of the film carrying the sound was separated from that carrying picture.

Q191. And then are the two negatives developed separately? A. They were developed separately— 555

Q192. And differently? A. And by quite different operations. The picture record was developed in the usual manner and the sound record was treated by an etching process, so that a line, a shallow depression, was produced in the metal strip.

Q193. Now, will you refer to the Reimer German patent which is item 15 in our book of patents? This patent is for a process for the making of a film which consists of an image band and a sound band. Describe briefly what that process was. A. In this case, the picture and sound were recorded on different media or materials, the

picture being photographed in the usual manner and the sound record being made on a material of the phonographic type, a disc or cylinder.

Q194. And did you say those are made simultaneously but separately? A. They are made simultaneously, but on separate materials.

Q195. And then what do you do to get positives? A. The picture was printed in the usual manner on the positive picture film and then a record was made from the phonographic record-
557 ing, which was then attached to the positive picture record.

Q196. Now, will you refer to the Rosenberg British patent, which is item No. 10 of our book? This is entitled, "Improved Means of Simultaneously Recording or Reproducing Sound and Visible Movements Accompanying such Sounds." Were those records of the sound and visible movement made on strip film? A. Yes, they were recorded on motion picture film in the usual manner.

Q197. The sounds and the pictures were re-
558 corded simultaneously, or otherwise? A. They were recorded simultaneously.

Q198. And in synchronism, I suppose, then? A. Naturally in synchronism.

Q199. And on the same film or on separate films or either? Does it provide for one or both? A. He provides for recording either on the same film or upon separate films.

Q200. Suppose they were recorded on separate films. What does he do with those two films after he has developed them? A. The patent provides for the printing of the records onto separate films.

Q201. That is, on the same positive film? A. On the same positive film.

Q202. If they were on the same positive film, what relation, as far as position is concerned, do the sound sequences have to the picture sequences? That is, they run parallel to the picture sequence or at right angles? A. They run parallel to the picture sequences, alongside the picture sequences.

Q203. Now, where Rosenberg discloses the recording of the sound and picture record on separate films, does it appear in this patent why he reproduced them on a separate film? A. He 560
wished to provide means whereby the sound record could run at a higher velocity through the reproducing mechanism than that in use in the case of the picture record.

Q204. Doesn't that get the two out of synchronism? A. No, because their relative velocities in projection are the same as those used in recording.

Q205. Is there any advantage to be gained by running that sound record at a little higher speed than the picture record? A. Yes, there are advantages, one of which is the ability by that 561
method to record and reproduce higher frequencies of sound than could be recorded and reproduced in operating the film at a lower velocity.

Q206. That is because you have more linear space to record those frequencies in, is that it? A. Yes, that is the case. The scanning line used in both recording and producing has a certain finite width, and when in the case of high frequencies of sound, that necessitates the use of very narrow lines, and in case the frequency increases sufficiently, the width of the scanning line may be sufficient to completely wipe out the modulation which is required to record the sound.

562 *Lloyd A. Jones—For Defendant—Direct.*

Now, by moving the film at a higher velocity, it is possible to spread these lines farther apart, and thus get satisfactory records of higher frequencies.

Q207. Now, will you refer to the MacCarty French patent, which is item No. 16 in our book? It is the last one in the book.

Mr. Ward: If it please the Court, I would like to say at this point that, of course, I have not had time to read these
563 new patents over, but if, after reading them over, I find they are anticipatory in character rather than illustrative of the art, I would like to object. I don't know what they contain.

The Court: My mind won't be confused. I won't consider them for anticipation, if they are not pleaded.

Q208. Now, Mr. Jones, does this patent disclose a simultaneous recording of sound and picture records on one or on more photographic
564 films? A. It discloses the simultaneous recording of sound and picture on the same sensitive photographic film.

Q209. And that is shown in Fig. 3, is it not; I mean the film resulting from that is shown in Fig. 3? A. Yes, that is the case. It is shown in Fig. 3, which carries both the sound and the picture record.

Q210. And that is a variable density sound record, not a variable area? A. Yes, that is variable density.

Mr. Neave: Your Honor, on page 2, the patent says that "Fig. 3 shows a part of the film. The alternating light and dark

565

bands 4 and 5, which seem to be extremely irregular are in reality extremely regular and harmonious, only their order changes with the corresponding changes of sound of the voice."

Q211. What would you say as to whether or not the record here disclosed shows that it is exposed variously in correspondence with vocal and other sounds, having slight differences of tone or intensity? A. I should say that it cer- 566
tainly means that it has been exposed to slight differences of tone and intensity, since that is a characteristic of sound in general.

Q211a. What does the record of the sound and pictures simultaneously on the same film have to do with the synchronism or lack of synchronism? Is it any better, is it any easier, or is it any more difficult to get synchronism when you photograph on the same film rather than on two? A. Well, of course, if it is recorded on the same film, synchronism is certain.

Q212. If it is recorded on separate films you 567
have to be careful, is that about it? A. Yes, that is the case. It is perfectly possible, of course, to obtain synchronism on two films, but it is perhaps somewhat more certain on one.

Mr. Neave: I offer in evidence a copy of the French patent, 532,750 to Vogt, Massolle and Engl, together with a translation.

(Marked Defendant's Exhibit H in evidence.)

Q213. Now, referring to this French patent, Mr. Jones, do you find in this patent or do you

568 *Lloyd A. Jones—For Defendant—Direct.*

not, disclosed the recording of sound and pictures simultaneously on separate negative films? A. Yes, that is disclosed.

Q214. Now, refer to the portions of the translation in which you find that. A. On page 2, last sentence, it says: "During the motion picture recording of the original plastic scene, one can couple in a positive manner to the motion picture film driving mechanism, the film winding drum of a separate and distinct acoustograph."

569 Q215. What is an acoustograph? A. Sound recording machine.

Q216. Then, what is done, according to this patent, with the two separate films after they have been recorded, after the sounds have been recorded on one and the picture has been recorded on the other? A. They are copied onto the same single positive film.

Q217. Of course, they have to be developed before that? A. Oh, yes, naturally.

Q218. Now, is this development, after the negatives have been exposed, referred to in the speci-

570 fication? That is in the second full paragraph on page 3, is it not? A. It is on page 3. The patent states: "The subsequent treatment of the picture films, after the exposure, is, in both cases, the same as far as the printing process, reproduction process, etc., are concerned."

Q219. Then, it goes on to say that they may be copied onto the same positive film? A. Yes.

Q220. Now, there are two methods of recording, are there not, disclosed in this patent? A. Yes.

Q221. Describe each of those methods. A. One method describes the recording of the sound and the film simultaneously, and in the other case,

the sound may be recorded subsequently—other sounds may be recorded subsequently.

Q222. Now, if that is done, what is the result as to whether or not the things have to be separately developed? A. Of course, they must be developed separately in both cases if they are recorded on separate films.

Q223. What is the other method of recording that is spoken of here? That is, one method, as I understood you to say, was to record the sound at one time, and the picture at another time, was that it? A. Yes, that is the case. 572

Q224. Well, is there any other method disclosed there? A. Yes, the simultaneous recording; I thought I mentioned that previously.

Q225. I beg pardon. I just wanted to bring that out definitely. A. Yes, sir.

> Mr. Neave: Your Honor, toward the end of this patent, as you will see, are the claims. It is on page 4, it is this French patent: "This invention refers to a photophonetic film." 573

Q226. That is a picture-sound film, isn't it? A. That is correct.

Q227. "To accompany images or pantomine, produced by tranverse light markings, and showing the following characteristic features", what does that mean? A. That means the sound.

Q228. "And showing the following characteristic features which can be taken advantage of either separately or in combination." Now, the second of these features that are enumerated here, marked 2, is: "Its impression, simultaneous with the original motion picture recording,

574 *Lloyd A. Jones—For Defendant—Direct.*

by sound sources which are not scenic (or, at least, are only partially scenic)", what does that mean? A. Well, it means that some of the sounds may be outside of the scene that is being photographed while others are inside and originate as a part of the action.

Mr. Neave: Then, the fifth feature which is mentioned in the introductory paragraph is:

575 "The copying of two series of photograms of the picture and accompaniment films"—

The Court: The translation is wrong on that number 2, they use the word "scenic" or "type"; it should be "which are not scenic", and then in parenthesis, "or at least are only partially", that should be the end of the parenthesis, and "scenic" should follow that.

Mr. Neave: Yes, I think that is correct.

576 The Court: That is so in the original.

Mr. Neave: Then, the fifth is, "The copying of two series of photograms of the picture and accompaniment films on the same film band."

Q229. Could you copy the two records from the negatives on a single film without first developing the negatives? A. No, that could not be done.

Mr. Neave: Your Honor, Mr. Ward put in evidence the DeForest patent which was in interference with the patent in suit, and he did not put in evidence the rest of the

577

history of that, and I want to put that in evidence and I offer the complete record in that interference proceeding.

(Marked Defendant's Exhibit I in evidence.)

Mr. Neave: This your Honor,—of course you understand I am offering this merely for the purpose of showing what happened there.

The Court: You are adding it to explain the decree.

578

Mr. Neave: Yes; that is, he offered the decree.

Mr. Ward: I offered the decision. I haven't any objection, I am just checking this over.

Mr. Neave: I am offering it to show what happened. I am not offering it in evidence, as to the proof of any of the statements therein made.

In order to complete this, I offer in evidence a copy of the File Wrapper and contents of this DeForest patent.

579

(Marked Defendant's Exhibit J in evidence.)

Mr. Neave: This is only a photostat I am offering here, Mr. Ward.

Mr. Ward: That is all right. Your Honor, I notice that this DeForest record so-called in Exhibit I contains the briefs of the two parties. I do not think they should constitute any part of the record.

Mr. Neave: The briefs are extremely interesting, because they show what position Mr. Ward was taking there as distinguished from the position he is taking here.

580 *Lloyd A. Jones—For Defendant—Cross.*

Mr. Ward: The briefs, I have no objection to the briefs, but they do not constitute any part of the record. If your Honor wants to read the briefs, all right.

Mr. Neave: It is agreed that the specification of the DeForest patent 1,489,314 as filed is the same as the specification as issued.

Mr. Ward: But not the claims.

Mr. Neave: That is right.

581 Q232. Mr. Jones, you saw here yesterday some of these charts Mr. Hoffmann put in evidence, being Exhibits 14 and 15. As I understand it, these charts or curves were made up by doing some work on the same photographic emulsions, same photographic material, and then using the developers according to the formulae that the defendant uses in its actual work for its picture and sound negatives. That being so, what is it that those curves mean? Do they mean that the developers have the same characteristics, the developments have the same characteristics or dif-
582 ferent characteristics? A. I should say they show they have developments of the same characteristics, character.

Cross Examination by Mr. Ward:

XQ233. Mr. Jones, attempting to cross-examine a man of your profound knowledge on this intricate subject, I feel almost as David must have felt in approaching Goliath, but I will try to see if we can straighten out a few things that I do not understand, but perhaps the Court does.

You testified in substance at page 255 of your testimony that you spent much time in the studios of the different producers. Will you state wheth-

er this experience has made you thoroughly familiar with what the Western Electric interests have been pleased to call their process for producing unitary sound and picture positives? A. Yes, I think it has.

XQ234. How familiar are you with the practices in the studios of their different large licensees such as the defendant here? A. Why, I think I understand the general principles of recording sound by the Western Electric system.

XQ235. Do you frequently go into the studios of their larger licensees? A. I should not say 584
frequently; naturally most of my work is in Rochester. Once in a while I find it possible to visit the studios.

XQ236. How often have you been in the defendant's studio or the place, the plant where they produce, where they record, recording pictures and sound and development, where this process is carried out? A. Within what period of time?

XQ237. Well, I am asking you, how often have you been there, in the last three years, let us say? A. Three years—

585

XQ238. A half dozen times? I do not care about exact dates, you know. A. Oh, probably in the last three years, probably four or five, perhaps a half dozen times. That is approximate, yes.

XQ239. How long were you there in 1931, how many times were you there in 1931? A. I frankly cannot tell you; I do not remember dates, whether I was in the studio during 1931 or not.

XQ240. Can you tell us the last time that you were in there? A. The last time I was there was about three of four months ago.

586 *Lloyd A. Jones—For Defendant—Cross.*

XQ241. Was that after you were engaged as an expert in this case? A. Yes.

XQ242. After that time when you were engaged as an expert in this case, you went there presumably for that purpose, when was the last time that you were there up to then? A. I cannot recall definitely just when I was there the last time prior to that.

XQ243. Well, you understand I am talking about the Long Island Studio, plant or studio?
587 A. Yes, yes.

XQ244. Can you tell us whether it was in the neighborhood of six months before that or two years? A. Well, as I recall approximately it was probably a year or so prior to that.

XQ245. That would take you to about a year and a half from the present time that you were there last up to the time that you went for the purpose of elucidating yourself to give this testimony? A. I have no record of when I was there on the last occasion, but I have been there frequently within the last ten years.

588 XQ246. They were not producing sound records ten years ago, were they? A. No.

XQ247. When did they start producing sound records, if you know, sound and picture records? A. In about, approximately 1926 or '27.

XQ248. You are sure it was that early? A. I have no record as to when they started to make sound pictures, but that is just approximate.

XQ249. Might it have been as late as 1928, as far as you know? A. Possibly.

XQ250. Did you find in your visits to the various studios of the Western Electric licensees, or their subsidiaries' licensees, licensees of their subsidiary company, "ERPI", as we call it, that

these various producer licensees used substantially the same process for sound and picture production and attaining of the unitary positive film making the sound and picture negative? A. The same as what—that the various ones—

XQ251. Use substantially the same process? A. Yes, as far as I know.

XQ253. As to the defendant in this suit, they use the process or the feature you say of varying the speed of their machine to take care of the different qualities in the film stock? A. They vary it; that is one of the purposes for which 590 they vary it.

XQ254. With all due respect, it becomes necessary to bring in other producers now, other licensees than this defendant. Can you state whether some of the other licensees of Western Electric also use this practice of varying the speed of the developer machine for that purpose? A. I can't state that positively.

XQ255. Do you know whether any of them do? A. No.

XQ256. Well then, will you tell me how they 591 take care of this difference which you say exists inherently in the manufacture of your company's film, that is to take care of the varying development of the film? A. It might be taken care of by varying the concentration of the developer or the temperature.

XQ257. Do you know that this is done? A. No.

XQ258. Then there are three ways that you have given of taking care of this difference in the susceptibility of your film stock to developer, namely, varying the speed of the machine, varying the concentration of the developer and vary-

592 *Lloyd A. Jones—For Defendant—Cross.*

ing, what else, temperature? A. Temperature. You might also vary the agitation of the developer.

XQ259. And all of those ways would give the same result? A. They would give results of the same character; whether or not they would give results of a sufficient magnitude to take care of the difference, I am not prepared to state.

XQ260. I thought you said that those different features would take care of it? A. I say they
593 all may be used.

XQ261. Which one could be effectively used to replace this idea of changing the speed of the machine? A. You could change the concentration of the developer, that would probably be the most obvious way, we will say.

XQ262. And how about the time of the development, could that be successfully used as another alternative? A. The time is included in the rate at which the film travels through the machine. When I said that the rate of travel of the film through the machine is varied, that is
594 specifically intended as a means of varying the time of development. There might be other ways of varying the time of development; you could change the length of film in the developing bath, the actual number of feet in the developing bath; that would change the time of development.

XQ263. With respect to the process of simultaneously taking sound and picture records on separate films separately developing them in a manner suitable or appropriate for each and then printing from the thus developed negatives onto the same face of a single positive film at different longitudinal extending portions of that film so that one of the records is at one side of

and along the other record, to what extent, if you know has that method gone into use in this country? A. Quite extensively.

XQ263. How familiar are you with defendant's process for producing a single sound and picture positive film? A. For producing what?

XQ264. A single sound and picture positive film. A. I am familiar with the general steps in the process.

XQ265. I couldn't hear your answer. A. I am familiar with the general steps in the process. 596

XQ266. Have you personally observed the speeds at which the two developer machines run? A. You mean have I actually measured them myself?

XQ267. Yes. A. No.

XQ268. Have you ever examined any of the picture negatives produced on those machines to be able to state what the gamma was? A. I could not state the gamma to which they are developed by looking at a picture.

XQ269. Have you ever tested them, examined them, I said examined them? Have you ever 597 tested them or examined them in any way to tell what the gamma is? A. It would be impossible to even, by measurement, to determine the gamma to which a picture is developed without knowing all about the object of which the picture was taken.

XQ270. I am assuming that, I have asked you the broad question. You know what gamma means, don't you? A. I think I do.

XQ271. Well, I have asked you if you have ever examined or tested, taken all the necessary steps, whatever they may be, to tell us what the gamma is of the defendant's pictures? By that,

598 *Lloyd A. Jones—For Defendant—Cross.*

I mean the overall gamma of the positive film? A. No, not directly.

XQ272. Well, indirectly, how about indirectly? A. Yes, I have indirectly.

XQ273. How many times? A. Only a few.

XQ274. How many? One or eight? A. Perhaps half a dozen.

XQ275. You have tested it about a half dozen times. Were those different picture scenes? A. No, I have—I think that I have answered the
599 question incorrectly, if you apply your question specifically to the examination of the picture records. I have not done that.

XQ276. Well, what records did you have in mind when you said that you had examined some? A. I have made sensitometric tests to show how the developing formulas behave on the kind of film they are using, and I know from those and from that practice what the contrast is to which any film of a similar nature is developed in that process.

XQ277. Then, as I understand your testimony,
600 you have never examined or investigated the question of gamma on defendant's sound-picture records? A. Not by examination of the pictures.

XQ278. The only thing you have done is to take these test strips and run those through a machine and figure out the gamma of those test strips? A. That is right.

XQ279. Now, were the conditions of those test strips the same as the conditions on the various picture records that they would run through the machines? A. Approximately the conditions are made as nearly duplicable as possible.

XQ280. Mr. Jones, what is the effect, if any, of this difference or variation in the develop-

ment of your emulsion stock, what effect, if any, does that have on the gamma of a picture made on such stock, with a given development treatment?

XQ281. You do not understand the question? A. No, I do not think I do.

XQ282. Perhaps I can split it up for you. You have testified that the film stock put out by your company which the defendant is using has an unavoidable variation in its susceptibility to developers, to the action of a developer; that is 602 right, isn't it? A. That is true.

XQ283. My question is, what, if any, effect has that got upon the question of gamma of a picture printed on that stock in a given and definite development treatment? A. Well, it will change or control the gamma to which the picture is developed to a certain extent, depending upon the magnitude of the difference.

XQ284. All right, what is the extent or magnitude of the difference? A. That is very difficult to say without some quantitative information.

XQ285. Haven't you got it? A. I haven't it 603 with me. I have a general idea of how much that might accomplish, but it would be only a very rough approximation.

XQ286. Well, you know what the variation is in your company's film stock, don't you, you know the limits of the variation with respect to its susceptibility to development? A. I know it in a general way, but I haven't any quantitative values which I can quote at this time.

XQ287. Can you give it in a general way? A. For a fixed treatment, that is, constant development in a developer of constant composition or

constitution—I do not think I can state quantitatively just what that could be.

XQ288. Well, would you undertake to approximate it, qualitatively? A. Well, approximately —no, I don't like to answer that question without the evidence before me and which I have not with me.

XQ289. Well, you stated, I believe, that the defendant's machine was speeded up, did you, varying from 9 to 12 minutes, that is, the speed
605 was increased or reduced in a variation between nine and twelve minutes, to take care of this factor, variable factor, in your company's film, did you not? A. No, I did not intend to make any such statement. I said one of the factors which makes it necessary to change the development time from time to time is this thing which you have been talking about, the possibility of the variation in the rate of development between one emulsion and another, and the variation which occurs as any photographic material is stored and gets older. Now, that is one of the
606 things which may make it necessary to change the time of development in order to get a fixed contrast.

XQ290. What are some of the other things that make it necessary to change the time? A. A small variation in temperature will change the rate at which development proceeds.

XQ291. With all of your research work and deep delving into these subjects that you gave in your qualifications, you have not any substantial idea as to what percentage of variation in your company's film would be— A. I have evidence on that. I have quantative evidence on this, but I don't care to make any statement without that evidence before me.

XQ292. You have no idea in your mind as to what it is? A. I have an idea, but I don't feel that I care to make any quantitative statement without definite evidence in front of me. I might make a mistake. My memory might be incorrect.

XQ293. I don't want you to make a quantitative statement. I want you to let me have your opinion or recollection, if you please, as to what it is. You can make it as general as you want to.

The Court: You may be getting only a guess, unless he says he has a positive 608
recollection.

XQ294. You have not any positive recollection? A. No.

XQ295. And you have no positive recollection or idea as to what effect that will have in varying the gamma of the picture on that stock with a given developer? A. Well, of course, the effect of that factor will be directly in proportion to the variation, but I have no positive recollection of the magnitude of that over a period.

XQ296. You cannot say whether it would be a 609
variation of from, say, .9 to 1 or 1 to 1.1 in the gamma? A. No, I have told you that I have not a sufficient positive recollection of that to make a statement.

XQ297. Would you be able to get that information by tomorrow morning?

By Mr. Neave:

Q298. Does this disclose any confidential information of the Eastman Company? A. Yes, it does, to a certain extent. I cannot commit myself to get that information.

Mr. Neave: I do not think it should be done unless it can be shown that it is really essential to this case.

Mr. Ward: I consider it essential. Here is a witness who has undertaken to hire himself out as an expert in a patent case, and he makes certain statements about the result or effect of a variation in film, and I think it is important, from my standpoint, to couple that up with some other
611 variations.

Mr. Neave: May I ask this witness whether he has hired himself out for the purposes of this case?

A. I have not.

Mr. Ward: He has undertaken to testify and has testified about this variation.

The Court: He did not testify in degree. He testified generally that it was one of the things.

Mr. Ward: I think the degree to which
612 it is one of the things is important.

The Court: I do not see why he should have to tell what the Eastman Company does, if they claim it is secret to their business.

Mr. Ward: I really cannot see where the secret comes in.

The Court: I don't know. They may not want to advertise a variation of their product.

Mr. Neave: Can you not get from him whether it is important or not, without getting the exact degree?

Mr. Ward: He says he does not know anything about it. That is the trouble.

The Court: Well, the other side suffers from that, if it is of importance, if you show it is important.

Mr. Ward: It is important to me to support my contentions in rebutting some of the things which the witness has testified to.

The Court: I do not think his guess is of any importance. 614

Mr. Ward: I will drop it and take it up again probably tomorrow morning.

By Mr. Ward:

XQ300. You decline to get that information? A. I am not in a position to promise to get such information. I am not the management of the Eastman Kodak Company.

XQ301. In the testing of these sensitometer strips or whatever you call them, you get a certain gamma reading, do you? I am now talking about your test which you say you conducted of defendant's development process. A. That is correct. 615

XQ302. Going back to those tests that you referred to, you said you made about a half dozen of them? A. The tests I referred to were made in my own laboratory, tests on sensitometer strips, exposed in our standard sensitometer, and developed in the developers made up according to the defendant's formulas. They were developed according to the technique which we use in testing photographic materials—

XQ303. Now, wait a minute, the sensitometer

strips, as you testified, as I understand it, were not run through the defendant's machines? A. That is perfectly true.

XQ304. Well, now, will you tell us just exactly how you tested those? A. The sensitometer strips which I used to determine the action of the two formulas used by the defendant.

XQ305. Yes. A. The sensitometer strips were exposed in the usual manner on a standard Eastman type 2B sensitometer, using—

617 XQ306. Wait a minute. You are starting too far up. How did you develop them? A. The strips were developed in a tray, according to the standard technique which we use in testing all of our materials. The tray is filled with developer and is then rocked by hand by the operator. The man who makes these tests is one who does nothing but make sensitometer tests all the time, and he does hundreds of tests every day, and he has by long practice and skill become able to duplicate his results from time to time. It is the test on which we control our

618 product.

After developing those materials, those strips, for the fixed length of time, for a series of lengths of time, they were taken out, fixed, washed, dried and read in the usual manner.

XQ307. Now, did you do that work yourself? A. No, I did not.

XQ308. Did you see it done? A. No, I did not.

XQ309. You just turned it over to somebody else and told him to do it? A. I turned it over to the man who is in charge of the sensitometric section of my laboratory, who does all of that

work of testing our products all the time from day to day.

XQ310. And whatever results he gave you, you just accepted those as being correct? A. Yes, I know they are correct because—

XQ311. Because you believe in him? A. He is probably more skillful and more adept in doing that work than I am.

XQ312. How do you know that he had the developer, the two developers of the defendant? A. I don't know that—

620

XQ313. You took his word for it? A. I gave him the formulas. They were sent to our mixing room, and they were compounded with the greatest of care—

XQ314. One minute. You say they were compounded. You assume they were compounded with the greatest of care? A. That is right.

XQ315. You don't know that they were compounded with any particular care, do you? A. No.

XQ316. And you don't know that they were the formulas the defendant uses, do you? You don't know it yourself? A. No, if you put it that way.

621

XQ317. For all you know about these tests, they may have taken the standard formula of the Eastman Company? A. That is right.

XQ318. And that proceeding applies to the half dozen strip tests that you said you made, and does it also apply to these exhibits that you introduced here of microphotographs, Defendant's Exhibits D and E? A. Yes; I did not make those personally. They were done in the proper department of the laboratory where the men are specialized in doing that kind of work.

622 *Lloyd A. Jones—For Defendant—Cross.*

Mr. Ward: Your Honor, I object to all these exhibits and these tests on the ground that the whole thing is hearsay testimony of the witness.

The Court: You have them in evidence. The value of them may be greatly weakened.

Mr. Neave: It is a matter of weight.

The Court: I don't know. He says he did not make them. He does not know.

623 Mr. Neave: He does not know in the technical sense.

XQ319. Mr. Jones, at page 253 of the record, Q10, you mentioned the first years of your work with the Eastman Company, that you were working on the theory of tone reproduction or visual sensitometry. That reproduction had to do with color tone of pictures, did it not, rather than sound tone? A. It had reference to the tone reproduction in the optical sense, the reproduction of brightness.

624 XQ320. That is color? A. Not color, no; tone brightness.

XQ321. I guess I am over my depth now. A. We use the word "tone" in referring to the relative brightness of objects as distinguished from color.

XQ322. Let us get it to a lower basis: It relates to pictures, then? A. That is right.

XQ323. And in Q12 of your testimony, where you refer to your scientific contributions on the subjects of tone reproduction, to which you gave a great deal of attention, you were there again referring to the matter of picture tone? A. That is correct.

XQ324. You stated, I believe, at page 258, that George Eastman or the Eastman Company succeeded in making a flexible transparent support of cellulose nitrate. You know, do you not, the fact is that one Hannibal Goodman originated that? A. I believe there has been some discussion on the point.

XQ325. It cost Eastman several million dollars for appropriating that, did it not? A. I don't know how much it cost.

XQ326. You testified at page 260, Q25, that 626
as you understood the patent in suit, "The object of the invention was to provide different development treatments for the different picture scenes." As a matter of fact, Mr. Jones, what the patent mentions as a difficulty with the old process is that the picture sequence may be under-or over-exposed with respect to the sound sequence, does it not, rather than one sequence of pictures being over-exposed or under-exposed with respect to another sequence of pictures? A. No, I do not understand it that way.

XQ327. Well, suppose you take a look at the 627
specification, page 1, starting in at line 9:

> "In this procedure, however, there frequently occur in consequence of the changing lighting conditions in the cinematographing process, changes in the degree of exposure of the silver bromide coating, and this causes the picture sequence to be either over-exposed or under-exposed.
>
> "As the same film, however, carries close to the picture sequence the normally exposed sound sequence, these difficulties

628 *Lloyd A. Jones—For Defendant—Cross.*

> resulting from differences in exposures cannot be remedied in the case of combined negatives, by developing practices such as by weakening, strengthening, and so forth. They can only be remedied by subjecting the under-exposed or the over-exposed portions of the negative to separate appropriate treatments."

Don't you find a clear statement there that
629 the difficulty is the contrast or relation between the under-or over-exposed picture sequence with respect to the normal exposed sound sequence? A. No, I do not so interpret the language.

XQ328. What does the patentee mean by the statement, "As the same film, however, carries close to the picture sequence the normally exposed sound sequence"? You think he is not drawing a comparison there between a normal lighting of the sound and a lighting of the picture sequence which may be different? A. No, I do not interpret the patent in that manner.

630 XQ329. You do not find here any statement, do you, in this patent that one part of the picture sequence is to be developed and treated differently from another part of the picture sequence? A. Well, he specifically mention the difficulties of over—and under-exposure of different scenes, and then he speaks of methods of remedying the difficulties.

XQ330. And he expressly mentions the normal exposure of the sounds, does he not, and contrasts that with the over-or under development of the picture sequence, does he not? A. No, I don't think it is contrasted with the over-and under-development.

XQ331. I am willing to leave it there. Are you familiar with patents and patent drawings? A. To some extent, yes.

XQ332. What did you say? A. Yes.

XQ333. Is it your contention or understanding that patent drawings are made to scale or merely illustrative drawings? A. I think they are usually merely illustrative and not made to scale.

XQ334. You testified at page 261, Q30, that there was no disclosure in the patent of a standard width film, and at Q31, that Fig. 2 of the 632
patent is wider than the standard film and would not go through a standard gate. Where do you get the basis for those statements? A. The film in Fig. 2?

XQ335. Yes. A. Well, naturally, if it would go through a standard gate, it would then not run over the standard sprockets with which that standard machine is equipped.

XQ336. That is not what you said, Mr. Jones. You said specifically that the film in Fig. 2 is wider than the standard film and would not go through a standard gate. I ask you as a matter 633
of fact whether the film shown in Fig. 2 is narrower than the standard film? A. Of course, that statement was based on the assumptions that the perforations shown were separated by the standard width.

XQ337. What you meant was that assuming that Fig. 2 showed sprocket holes equipped for what is today a standard sound picture, that the over-all of the film would be wider than the standard? A. No, machines have been made for the last forty years with sprockets having a certain separation between them—

XQ338. Picture machines, not sound picture

634 *Lloyd A. Jones—For Defendant—Cross.*

machines for forty years; right? A. That is right.

XQ339. The picture machines? A. Yes.

XQ340. Go ahead. A. Assuming that the sprocket holes as shown in Fig. 2 are of proper separation to run through the standard machines, the standard picture machines, of the date of 1920, or something like that, this film would necessarily be wider than standard.

XQ341. And was there any such thing at the
635 effective date of this patent, 1921, as any standard practice with regard to sound picture projection? A. No, I don't think there was anything that could be considered standard practice.

XQ342. As a matter of fact, you know that there was no commercial use of sound machines at that date, do you not? A. That is right.

XQ343. So that at the time of this invention, there was nothing to standardize, to measure up any standard, was there? A. There was a perfectly definite standard mechanism for project-
636 ing silent pictures.

XQ344. Exactly, silent pictures. And at that time it had not been determined, had it, even whether the sound picture, the sound record, should or would go onto the picture record? A. No.

XQ345. Is it your contention that this process set forth in this patent is in any way prejudiced by the fact that the sound record is outside of the sprocket holes rather than inside? A. It is only prejudiced to this extent: That certainly when sound technique was being developed, there was a very large mass of equipment in use all over the world in thousands of

theatres in which a film of certain standard width, standard perforations, could be run. It seems obvious that commercially it would be desirable to make a sound film that would run through that machinery without serious modification.

Q346. Now, Mr. Jones, I take it you don't want to be put in the position of blowing hot and cold within a half hour. Didn't you intend to give the impression in experting such patents here as Bullis and one of those others which had a wide sound track, that there were advantages 638
in that track, that it was a good thing, didn't you do that? A. From certain points of view.

XQ347. And by putting this sound track of the patentees on the outside of the sprocket, as they show it, they also maintained that advantage that you allege for some of these other prior art patents, did they not? A. Yes, that is possible.

XQ348. And by doing so they also permitted the total field between the sprockets to be given up or retained by the pictures, did they not? A. That is true. 639

XQ349. And I think a few minutes ago or so, when Mr. Neave had you, you announced that that was a desirable thing, did you, and it is, is it not? A. It is desirable from certain points of view, yes.

XQ350. So that from a technical standpoint, the standpoint of desirable results short of commercial economy on account of cost of mechanism, it is desirable to have the type of film shown in Fig. 2, as shown in this patent? A. There are certain arguments for such a type.

XQ351. Well, now, let us get down a little

closer together, if we can: It is desirable from a technical standpoint or results to have the biggest field for your picture possible? A. You mean the biggest we can put on standard film?

XQ352. Yes. And it is desirable to have the sound track, sound marks, as wide as you can have them and get them on a film which can be economically handled? You said so, didn't you, in regard to some of these patents a while ago? A. Yes, I think it is desirable to have a sound
641 track of certain optium width,—probably I should not say as wide as possible.

XQ353. You know what I meant. I meant what you meant. Then the fact is that the only criticism you really have of this patent is that instead of, German-like, showing the best type from a technical standpoint, you criticize it because it has not got the American style of quantity production at a cheap rate, so to speak, using the standard machines rather than to have to change them and giving up some of the picture space for the sound picture in order to use
642 the same machines that we have been using? That is about what your criticism comes down to, is it not? A. Well, it is not the only criticism.

XQ354. At page 261 of your testimony, Q33, when asked what were the steps of the process of the patent where two separate films were used, you testified that the process involves the simultaneous exposure of the sound and picture records and the separate development of those, and then the printing of those two onto a single positive film. And then you started to say something else but stopped. I will ask you if the process as described in the patent does not also

involve the printing of the sound and picture records side by side on different longitudinally extending portions of a single film? A. That is the printing step which I believe I mentioned.

XQ355. I don't think you mentioned it. You were cut off in your answer. I just want to see if you complete your answer in that way. A. The answer, as I recall it, was intended to include three steps: The simultaneous recording, the separate development, and the printing of the two records onto a single positive film. Is 644 that correct?

XQ356. Different longitudinally extending portions side by side? A. I did not read the entire claim. I would say essentially it is a printing step.

XQ357. I did not know whether you left that that way purposely or not. And you say that that is a four-step process? That is what you testify to, that that was a four-step process. A. It is a three-step process, or in case we read it in the light of other disclosures and include the re-uniting of the negatives before printing 645 them, you have the possibility of a four-step process; either three or four.

XQ358. You have a simultaneous taking, separate developing, then the printing— A. The possibility of re-uniting—

XQ359. No, I believe that is the alternative process now that you discussed elsewhere. And then the printing of those two negatives onto a common positive? A. It is also possible in the light of the disclosures to consider re-uniting in this case.

XQ360. I am asking you about the one you

646 *Lloyd A. Jones—For Defendant—Cross.*

testified, at page 261, where you start off with two separate films. Will you look at your testimony there? A. I have not got the testimony.

(Testimony handed to witness.)

XQ361. You were testifying there simply to the process of the patent, where two separate films were used at the beginning? A. Is that Q32?

XQ362. 33, at the bottom of page 261.

647 The Court: Which patent is that, the patent in suit?

Mr. Ward: Yes, it is the patent in suit we are talking about. I am referring to his testimony.

XQ363. I don't want to hurry you, Mr. Jones, but I think the question is a simple one. I just asked whether the process that you testified about at Q33 was not the process of the patent where two separate films were used?

Mr. Ward: I will strike out the ques-
648 tion to save time, if the witness cannot answer it, and go on.

A. Yes, that seems to be correct.

XQ364. Mr. Jones, is it true that extending the time of the development of negative film increases the density difference of the negative? A. Increasing the time of development?

Mr. Ward: Read the question.

A. (Continued.) Yes, that is true under certain limitations.

XQ365. Let us have briefly the limitations. A. If development is carried to an extreme, a point

is reached beyond which you cannot raise the contrast.

XQ366. Now, do you know that of your own knowledge or is that also hearsay? A. I know that of my own knowledge.

XQ367. All right. Go ahead. I did not mean to interrupt you in your answer. A. I think the answer is complete.

XQ368. Is it also true that the extent of development of the film depends largely upon the time of development? A. Yes. 650

XQ369. Then a given exposed negative of a given photo will have a greater density difference if the time of development is increased, that is greater gamma, is that right? A. Up to a certain point where the gamma becomes constant.

XQ370. Well, in practice you do not work up on that point of the curve you are referring to, where the gamma becomes constant, do you? A. It depends upon the practice.

XQ371. Well, in general practice. A. I do not know what you mean by general practice. There are very many occasions where we have to develop the film up to the limit and get all the contrast that is possible. 651

XQ372. Why, you certainly do not do that with these machine developers that you let go and take care of themselves, where the light conditions are perfect? A. No, not in that practice.

XQ373. Now, in this practice, is it true that a given exposed negative of a negative stock will have a greater density difference if the time of the development is increased, that is, greater gamma? A. Yes.

652 *Lloyd A. Jones—For Defendant—Cross.*

XQ374. In the development of the film, does the time, assuming all other factors being the same, a certain variation in the time of development will vary the extent or degree of development of the film? A. It will vary the extent of development.

XQ375. That is, it will vary the gamma of the resulting film? A. Yes, that is true.

XQ376. Referring to your testimony at page 273, as I understand the testimony you state in
653 substance that the negative developer, that is the developer for the defendant's picture film, is one of relatively low concentration, and is intentionally made so in order that it may act on the picture negative for a relatively long time, and that this may be done because the negative film inherently is a relatively slow developing material, and uses a fairly long time in order that the sulphite may exert its solvent action and produce an image of relatively fine grain structure; and in the next paragraph of your answer, you state, on the other hand, that the
654 positive film used by defendant is inherently one which develops very rapidly and for practical convenience and expediency it is desirable to run it as fast as compatible with good results. It is a fair synopsis of this testimony that I have referred you to to say that the picture stock of defendant requires a developer of lower concentration acting for a relatively long time, to get the desired result, and on the other hand, that the sound stock of defendant is one that develops very rapidly and is run at a relatively rapid rate through the developer? A. In order to get the desired contrast in the two cases.

XQ376. Exactly. Will you please tell us, if you can what would happen if you took defendant's undeveloped picture negative and attached it to the corresponding or accompanying sound negative of defendant, which is on positive stock and ran the two through defendant's sound negative developing machine containing the defendant's sound developer? A. I can't tell you offhand just what contract would be obtained in that case, because we are putting a slow developing material through a more concentrated 656
developer. Now, just how it would balance up, I would have to refer to data in order to find out.

XQ377. Now, Mr. Jones, with all of your profound knowledge and experience, practical and theoretical, you have a pretty good idea, haven't you, of what would happen if this positive stock went through that same developer with the negative stock asserted in my question?

Mr. Neave: What developer are you using?

Mr. Ward: Defendant's sound developer. 657

A. Yes. You would get a somewhat higher contrast than if you developed in the negative developer.

XQ378. Now, what do you mean by that, you would get a somewhat higher contrast on what, on the sound record film or the picture record film? A. No, as I understood your question, you said, you asked what would happen if the negative stock were run through the picture formula—

XQ379. No, you have got it wrong. A. The negative stock through the sound formula.

XQ380. With the sound stock? A. Well, it would develop to a higher contrast—

XQ381. Just one moment, the proposition I have put to you in as simple language as possible is that you take the picture negative exposed but not developed, and the sound negative exposed but not developed, take two of them, and then you put those together through defendant's developer machine for sound, using defendant's sound developer machine. What would be the
659 result as to picture and sound, the records that would come out? You can first give me the sound, that is, if you want to, and then the picture, but I really want the contrast between the two. A. I still do not see—

XQ382. Answer it in your own way. A. You must assume that the sound film is going through the sound formula for the usual time?

XQ383. Correct. A. Of, say, four and a half minutes?

XQ384. Correct. A. The negative would have a lower contrast than the sound.

660 XQ385. That is, the picture negative? A. The picture negative would have a lower contrast than the sound.

XQ386. That is, the picture negative would have a lower gamma than the sound? A. That is right.

XQ387. Can you tell us approximately how much lower? A. Yes, I can tell you approximately.

XQ388. Give it as nearly as you can from the data that you have. A. It would be about .18 lower in gamma approximately.

XQ389. That is, the picture record would be

.18 lower in gamma than the sound record? A. The picture, yes, the picture record.

XQ390. There would be a difference— A. The record on the negative film, in other words.

XQ391. Yes. A. On negative stock.

XQ392. There would be a difference of 1.8? A. No, .18.

XQ393. A difference of .18? A. Yes.

XQ394. Now, did you ever try that? A. Yes, I have tried that, running the test sensitometrically in the usual laboratory manner; I have not 662 tried it in those actual machines.

XQ395. Now, what would happen if you took defendant's sound record on its positive stock and attached it to the corresponding or accompanying picture record, as taken by defendant, on its negative stock, and ran both pieces together through defendant's picture developing machine, containing the picture developer? A. You would get a higher contrast on the sound negative.

XQ396. That is in this case, it is the reverse of the former case. In this case, you get a higher 663 contrast on the sound negative? A. On the sound negative.

XQ397. Will you please tell us what the difference in contrast is between picture and sound in this instance? A. Well, there will be approximately .3 in gamma. Of course, again, my values are based on laboratory sensitometric tests run in these two developers, not on the developing machines.

XQ398. And with reference to this last test that you have talked about, you actually tried that out, you have curves there for the trials of it? A. That is correct.

XQ399. Will you please then give us the actual gamma rather than just the contrast? Give us the actual gamma of the picture negative and the actual gamma of the sound negative? A. The actual gamma of the picture negative is .60 and for the sound negative, that is, on positive stock, is about .9 or just a little less than .9.

XQ400. Now, will you revert back and give us the actual values of gamma for the picture and sound in the previous instance where you
665 ran them both through the sound developer? A. On the sound negative recorded on positive film, a gamma of .5 and for the picture negative, recorded on negative film a gamma of about .32 or .35, as near as I can place it.

XQ401. In Q74 at page 277, Mr. Jones, you testified that there would be no advantage in giving defendant's positive emulsion sound record a different character of development from that used for the negative emulsion of the picture record. You did not mean by that, did you, that there was no advantage in giving them separate
666 or different development treatments, did you? A. I meant just what I stated in the answer, that there would be no advantage in giving them different characters of treatments.

XQ402. And in giving that answer you used—

A. What is the page, may I ask?

XQ403. Page 277. I think it starts there. In giving this answer and using that expression, "character of development", you used it as you have defined that term in your testimony, namely as applying to the use of developers having in general the same active ingredients even if in different proportions? A. Yes, I mean developers having the same active ingredients.

XQ404. Regardless of differences in the proportions of the active ingredients? A. Any development of the same character.

XQ405. That is, so long as they give the same granular structure? A. Same granular structure, same color of image, same sort of division of silver deposit and same shape of characteristic curve apart from those differences, which are a function merely of the time the material is left in the developer.

XQ406. Your answer that I referred to, really 668
wasn't intended then to convey any idea that there was no advantage in giving the defendant's positive and negative stock different development treatments? A. Yes, I think there was a real meaning. I meant there is no advantage in giving the defendant's positive and negative stock different characters of treatment.

XQ407. I didn't say character. Read him my question.

(XQ406 repeated by the Reporter.)

A. No, not different development treatments. 669

XQ408. And you did not mean that there was no advantage in using with defendant's sound and picture negatives respectively the respective developers and times of development that defendant uses? A. No, I meant to convey the idea that the only thing that it is necessary to do in developing the defendant's picture and sound negatives is to give them the same character of development, by adjusting the extent of the development to obtain the necessary contrast in the case of the two materials.

XQ409. And they do that in defendant's case

by using a different developer, even if of the same character, and a different time of development, don't they? A. That is true.

XQ410. Where you testified that the sound negative and picture negative obtained by defendant as a result of those two separate development treatments, one for each, resulting in "negatives of the same character", here again you use the term "same character", in the sense that you defined it in your testimony, did you
671 not, that is negatives having been developed from the same type or character of development? A. I mean negatives having been subjected to the same character of development, and in this particular case, the defendants, having been adjusted to give approximately the same contrast in addition to that.

XQ411. And developers also having been shown to assist in giving that— A. Naturally the time of development has to be determined as a result of the concentration of the developer, the activity of the developer.

672 XQ412. So the defendant selects developers of different intensities and uses them for different times to get what it is after here in the way of contrast: is that correct? A. Developers of different concentrations.

XQ413. You prefer the word "concentrations", to "intensity", or activities would be another word? A. Quite right.

XQ414. At Q72, you testify that each of the two developers of defendant produced a deposit on the film of practically identically the same granular character. What do you mean "by practically identically the same", in that case? A.

I mean that they are inappreciably different for all practical purposes.

XQ415. You do not mean that if defendant's positive stock and negative stock for the sound and picture are developed together in the same developer and for the same length of time, in other words, with all factors the same except the stock, that the granular characteristics of the two films would be practically identical, do you? A. No.

XQ416. You do not mean by your answer to 674
Q72 to say that defendant does not have to use different development treatments with the picture and sound stocks in use in order to get the results it is after? A. No, it is necessary to use different times of development in order to obtain the desired contrast in the two cases.

XQ417. And it does use the different developers of different intensities, as you call them? A. Yes, it uses developers of different concentrations.

XQ418. In Q73, in your answer, you state as to the shape of the characteristic curve of de- 675
fendant's sound stock and picture stock, "they are identically the equal contrasts". I think that is wrong. What should it be? A. They are identical at equal contrasts.

The Court: Do you want to make that correction on the record now?

Mr. Ward: Yes.

XQ409. But you cannot get that condition with defendant's sound and picture stock without developing them for different lengths of time and/or in different developers, is that right? A. You might get that condition quite easily by de-

676 *Lloyd A. Jones—For Defendant—Cross.*

veloping for the same time in developers of different concentration. The and/or bothers me.

XQ410. At page 276, Q69, in giving the reason for the different proportions of the ingredients in defendant's respective developers, you state, "It is merely a question of practice". What do you mean by "It is merely a question of practice"? Do you mean to say it is merely an arbitrary matter? A. No, I mean to say that it is a question of expediency, practical expedi-
677 ency from the standpoint of adjusting the concentration so that the desired contrast will be obtained in a convenient time.

XQ411. Well, then, it is a question of doing it to get what they are after, isn't it? It is done to get that picture record negative developed the way they want it developed in a proper way? A. It is done in order to get the desired contrast in the picture negative.

XQ412. And defendant selects its sound negative developer and time of development because this development treatment acts on the sound
678 negative in a manner appropriate to the sound negative; isn't that true? A. It does not act in any different manner or in any appropriate manner. It acts at a proper rate, it gives the desired extent of development.

It seems to me that we are confusing to a certain extent the use of the two words, "extent of development" and "character of development". Character applies to different kinds of development, it connotes a difference in kind, while the extent refers merely to differences in degree.

XQ413. Now, one moment; do you find anything in my question about character of develop-

ment or the other kind of thing you were taking issue with? A. If you mean by that that the appropriate manner is one which will give the desired contrast or extent of development, that is the case.

XQ414. "Suitable manner" would suit you better? A. Suitable extent.

XQ415. You have testified at Q64 that there are certain unavoidable variations in film stock, one of which is "the rate at which it develops". Is it not also true that another unavoidable vari- 680
ation in film stock is its sensitivity or rate at which it will be exposed by a given light source? A. Yes, that is true; it is impossible to make it all precisely the same speed or sensitivity.

XQ416. Can you state which variation the film stock is more subject to, the variation in rate at which it develops, or the rate at which it will be exposed by a given light source? A. I cannot make any quantitative comparison there, and it depends a great deal on how we express these differences, as to which is the greater.

XQ417. Before you go any further, this in- 681
formation would not hurt your concern any, to tell us the relative differences. A. I do not think I know how to answer your question in quantitative terms.

XQ418. I did not want to go any further on that if your answer was yes. What I mean is, from your knowledge of the situation, which of these difficulties is the film stock in general more susceptible to? A. That would be very difficult to say.

XQ419. That would be difficult to say? A. Very difficult, as to which is the more susceptible.

682 *Lloyd A. Jones—For Defendant—Cross.*

XQ420. Haven't you often had to investigate a matter of this kind? A. Yes, but I haven't a sufficient mass of data before me to make a quantitative comparison.

XQ421. They both have given trouble in a practical sense, haven't they? A. They both certainly have to be encountered in practice.

XQ422. And they both have been subject to investigation and consideration by your concern, haven't they? A. Yes, that is true.

683 XQ423. And aren't you the head of the department, the fountain-head of knowledge that they would come to on that matter, so to speak? A. I should say there are other fountain-heads.

XQ424. I mean you are *the* one, are you not? A. No, I do not think that is necessarily true. My activities are of a research nature. Now, I do not see tests from every emulsion that is made. It is not a part of my duty to collect and tabulate quantitative data on the variations of product from day to day. I therefore do not feel qualified to speak quantitatively on that sub-

684 ject.

XQ425. I do not think I have ever asked you for any quantitative information, Mr. Jones. You are at the head of the whole outfit there in this line, as I understand you, and it does seem to me that there is a situation of practical difficulty in these two respects, and you ought to know, I should think, if you will permit me to say so, which of these is the most aggravated condition. A. You are asking me, however, to state which is the greater. Now, I cannot state which is the greater variation without quantitative data before me.

XQ426. I see. You have no definite knowledge on that subject now as to which is the greater? A. No, I haven't.

XQ427. Have you any idea as to which of the two would affect this question of gamma the most? A. Well, I think, assuming a correct exposure of material, the rate of development will affect the gamma more than the sensitivity difference.

XQ428. And you have testified that the speed of defendant's machine is varied to take care 686
of the difference in the rate in which the film will develop, is that right, or didn't you so testify? A. I say that is one of the factors which makes it necessary to change the rate of development.

XQ429. Would another factor be this last definition that I have spoken to you about, the varying sensitivity or rate of exposure of your film stock? A. No, I think not.

XQ430. Will you give me the other reasons for changing the speed of the machine that you had in mind? A. I have mentioned before slight 687
variations in the temperature at which the bath was held.

XQ431. I understand they hold that constant. A. Of course, nothing is held absolutely constant; there is always a certain tolerance in any physical measurement.

XQ432. And there are no other reasons than the ones you already testified to? A. There may be; there may be other contributing causes. The concentration of the developer is also held constant, but there again there is no possibility of obtaining an absolute constancy. There is always a certain small variation.

688 *Lloyd A. Jones—For Defendant—Cross.*

XQ433. Is it an easy matter to change the speed of defendant's developing machine from one length of film to the other? A. You mean while film is traveling through the machine so that two consecutive scenes would receive different times of development?

XQ434. Yes. A. No, I should say not.

XQ435. It is not an easy matter? A. No.

XQ436. You don't know the practice of putting lengths of unexposed film between consecu-
689 tive shots, so to speak? A. No, I am not familiar with that.

XQ437. You never heard of that? A. I am not familiar with that practice.

XQ438. As far as your knowledge of the operation of these machines goes, do they take, say, a shot out on a snow scene and connect it right up with a shot of a fog, if they want to, together, and put nothing in between at all? A. That is the practice, as I understand.

XQ439. Now, you said something in regard to the cameramen being able to keep their cameras,
690 their openings so adjusted as to always be able to get the necessary illumination, so that they are not troubled with over- or under-exposure of film anywhere. With regard to recording pictures, take the case where there was a brilliantly lighted scene outdoors, such as a snow scene on a bright sunny day, and another scene in proximity, with the light quite dull, such as a fog scene, or take the case of a scene where a man is walking from a brilliant sunshine on the street into a dark hall, or the case of a studio scene where one goes from a brilliant light into a dark closet or hall. In those cases is the cameraman

able, following that party, to instantaneously adjust his lens opening— A. Not instantaneously, no.

XQ440. Would he have any time to do it at all in cases like that? A. Yes, as I have usually observed the practice, you have plenty of time to adjust—

XQ441. Following a man from a brightly lighted street into a dark hall, he would have time to adjust his shutter as he followed along? A. I think I misunderstood your question en- 692
tirely. I am sorry. Your question refers to a continuously photographing a scene which is changing?

XQ442. Yes. That is very frequently done, is it not? A. Yes.

XQ443. Now, in cases of that kind, Mr. Jones, don't you think you are able to get under- and over-exposure? A. It is probable that you will get variations in exposure. Whether those are sufficient to cause over- and under-exposure in the sense that we use the term is quite question-
able. Of course, the photographic film has a con- 693
siderable latitude, and even though a film may have, one exposure may be less than another, the two negatives produced therefrom may be negatives of perfectly satisfactory quality and produce perfectly satisfactory prints.

XQ444. Yes. You say that you have considerable latitude in the films. How long have you had that latitude? A. Always had latitude.

XQ445. Had it in 1921? A. Yes.

XQ446. Having the same latitude in 1921, and I assume that the actinic rays of the sun have not changed any since 1921, won't there be just

694 *Lloyd A. Jones—For Defendant—Cross.*

as much trouble from under- or over-exposure in these cases today as there were in 1921? A. Not necessarily at all. It does not follow.

XQ447. Why not? A. I have not made any statement to the effect that the latitude of the film is so great that you cannot make under- and over-exposures. It is quite possible that you can make under- and over-exposures. I have merely stated that there is a certain latitude over which you can have a changing lighting
695 condition without running into serious over- or under-exposure.

XQ448. I understood you to state on your direct that in view of the experience that these cameramen have had in the last five or ten years, that there was no danger from under-or over-exposure any more, so you could just put these thousands of feet, costing hundreds of thousands of dollars, right through a machine and turn a crank, and depend on their coming out O. K. at the other end. If they did not come out O. K., there would be a great monetary loss.
696 You practically testified to that, did you not? A. That is the present practice in machine development.

XQ449. Now, I ask you what is the change in conditions, what are the changes in conditions in the film or in the actinic rays of sunlight or lamp-light from 1921, when this patent application was filed, and today, which makes the danger of over- or under-exposure less today than it was then? A. There has been no change in the sun or the lights and perhaps not a great deal of change in the film, but then there has been a great deal of change in what the camera-

men know, and the knowledge that they have of being able to give correct exposures. There have been improvements in the technique of studio lighting so that it can be controlled within smaller limits.

XQ450. That is, for a given set of lighting? A. It applies to studio lighting in general.

XQ451. Take these changes I have been talking about— A. One thing that has happened, they have adopted quite largely the use of incandescent lighting which gives light of some- 698
what appreciably less variation than was formerly used when arcs were more commonly used, were more extensively used.

XQ452. I will read you your answer or the question and answer, Q52, page 269:

> "As a matter of fact, does the disclosure of the patent in suit contemplate or does the object of the alleged invention as there stated relate to or having anything to do with sound and picture records in which the picture record, as well as the sound record, has been continuously 699
> normally exposed? A. No, it does not."

Will you please tell me what you meant by that testimony? A. As I stated previously, I considered the object of this alleged invention to be a method whereby the differences in exposure of the various picture scenes may be developed separately and therefore suitable corrections be made as per the usual practice at that time, without having to give different development treatments to the corresponding portions of the sound record, which, according to the specification, are normally exposed.

XQ453. Mr. Jones, you gave us yesterday some gamma data with regard to those sensitometer strips which you said you had some one test. Will you please give us the data, the gamma data, as to the positive prints with respect to the strips tested in the defendant's positive developer and that tested with the negative developer? A. You want the gamma value on positive film—

XQ454. Yes. A. —obtained by developing that
701 in the positive developer?

XQ455. That is right. A. That is the sound track developer?

XQ456. That is right. A. And the picture negative?

XQ457. Yes. A. For the same lengths of time?

XQ458. No. We want the positive gamma in the normal process that defendant uses in making its positive prints? A. The positive stock carrying the sound negative, developed in the sound developer, develops to a gamma of .52.

XQ459. Can you give us the gamma for the
702 combined picture and sound on the defendant's positive stock? A. The combined picture and sound, I have no specific data on that, that is made in the formula. There has been no formula disclosed for the development of the positive, combined picture and sound positive.

XQ460. I don't care about the formula for that. I say taking it this way, to get it clear: Where they are developed, their sound positive stock in their sound developer, and their picture negative stock in their picture developer, and the print onto the common positive, the sound and the picture records, and develop that,

that final strip as the resultant gamma? A. That is the final positive?

XQ461. Yes. A. I know from my general knowledge of the subject that that is developed to a gamma of approximately 2.

XQ462. Will you tell us how you know it from your general knowledge? A. Well, just my general experience for a great many years in the process of making motion pictures. We know, we have measured various of the contrasts obtained in various developers, used in various 704 places, and we know that that procedure is one which gives a satisfactory picture quality.

XQ463. And do you know that that is the gamma of the defendant's final product? A. I don't believe I have any actual measurements before me made in a developer compounded precisely according to that used by the defendant, but I am normally certain that that is the practice, to develop the final picture positive to a gamma of approximately 2. It is the common practice in making good pictures.

XQ464. Now, you gave us some figures result- 705 ing from those tests that you say you had somebody make up for you with respect to gammas yesterday. Will you state what were the limits of the gamma as those tests showed, both for the sound and picture positive prints? That is, your strips, I assume, had indicated some variations in gamma, your sensitometer strips? A. Variations with what factor; with time of development?

XQ465. Variations as to contrast for different times of development. That is, all of the strips, the tests on each strip were not identical, were

706 *Lloyd A. Jones—For Defendant—Cross.*

they? A. You mean repeat strips of the same development time, what you might call the experimental variation in measuring: is that the idea?

XQ466. I will put this question to you rather than have you answer the other. What were the time limits of the development of those strips which you tested or had tested? A. The original group of tests on which the results were based, the time of development varied from three min-
707 utes to twenty minutes. Five different times of development were used in that interim. From the results of those measurements we plotted a time gamma curve for each developer and for each stock. That gives us a relation between the time of the development and gamma. A smooth curve drawn through those points then determines that function. From that curve we are able to read the gamma obtained in any time of development within those limits on any of the materials, on either of the materials and the development.

708 XQ467. Will you tell us to what time the value of .52 corresponds, what time of development? A. In which developer, and with which stock?

XQ468. As to both, as to the sound stock first, as to the sound stock in the sound developer? A. The positive motion picture stock developed in the sound developer to give a gamma of .52 required a development time of 4.4 minutes. The same stock, namely positive, developed in the picture formula to a gamma of .52 required a development time of six minutes.

XQ469. Will you give us the same informa-

tion with respect to the picture stock in the picture developer? A. I have given you in that question the information on positive stock developed in the picture developer, that was the second value I gave.

XQ470. Well, you misunderstood my question when you gave the information. A. I am frankly not quite sure what you want to know. I am very glad to give you all this information, if I can just be sure what you want. Those values that I just gave are correct, as near as 710
I can read this curve here.

XQ471. Well, now, can you give us the corresponding data with the picture stock in the picture developer? A. The picture stock in the picture developer?

XQ472. Yes. A. That is for a gamma of .52?

XQ473. No, that is to a gamma of .6, didn't you give a gamma of .6 yesterday?

The Court: No, he said .52 just now.
Mr. Ward: No, I mean yesterday. 711

XQ474. Yesterday, didn't you say that the picture stock was developed to a gamma of .6? A. I think I said .55, if I am not mistaken.

XQ475. Well, whatever you said, that is the gamma I want now in this question. A. The picture stock; the negative stock, we will put it that way, the negative stock developed in the negative formula gives a gamma of .57, as I read it now in 12 minutes.

XQ476. Are you reading it right as you say now? A. As near as I can read it on this coordinated paper, yes.

712 *Lloyd A. Jones—For Defendant—Cross.*

XQ477. What is the value of gamma for negtive sound development in defendant's negative sound developer at 65 degrees for four and then for five minutes? Give me each. A. The positive stock on which the negative sound record is made developed for four minutes in the defendant's sound developer, gives a gamma of .45 and developed for five minutes, gives a gamma of .59.

XQ478. Now, can you tell us what is the
713 value of the gamma for defendant's negative picture stock in defendant's negative picture developer at 65 degrees for nine minutes and also for twelve minutes? A. At nine minutes on the negative picture stock developed in the negative developer, nine minutes gives a gamma of .48 and for twelve minutes, a gamma of .57.

XQ479. I believe you testified yesterday that the time of development affected the gamma within certain limits? A. Yes, that is true.

XQ480. And I believe you testified that gam-
714 ma is affected by the concentration of developer, other factors being equal? A. That is correct.

XQ481. I believe you also testified that it is difficult to maintain the concentration of developer constant in practice? A. It is difficult to obtain it perfectly constant. It can be maintained fairly constant. In any such problem there is always a slight variation.

XQ482. And that slight variation will have some material effect on the resulting gamma, will it not? A. It may have a measurable effect, a measurable but small effect. It will depend entirely upon the precision with which concentration is controlled.

XQ483. I was talking about the practice, running these machines as they are run in practice there would be some variation, and that variation would affect gamma? A. That is true, there will be some variation.

XQ484. And that variation is such that it is worth while looking after, isn't it? A. Yes; it is necessary to take steps to maintain the concentration at a constant value.

XQ485. That being so is it not desirable to have the sensitometer strips accompany the 716
picture film in the development machine to get the correct gamma on that picture film from the strip readings of your sensitometer? A. Yes, that is true.

XQ486. I then take it that sensitometer strip readings that were derived from sensitometer strips which did not accompany the film would not be very reliable? A. No, that is perfectly true, they would not be reliable as a means of controlling the constancy of the process; they are perfectly reliable for some other purposes.

XQ487. Well, they wouldn't be reliable in 717
determining the gamma of the picture strip that didn't go along with it, would they? A. No, that is perfectly true.

XQ488. Is it true that the development accorded the positive print must bear a definite relation to that which has been accorded the negative? A. Yes, that is desirable within certain limits.

XQ489. Was the data on gamma which is contained in defendant's statement in Exhibit 12, *i. e.*, that the defendant's film over-all gamma was approximately 1.2, was substantially

1.2, and the over-all gamma of sound record substantially 1, was that derived from or based upon these sensitometer strip tests that you had made up at Eastman's? A. No, they were not.

XQ490. Your strip tests are in accordance with those figures or different from them? A. they agree fairly well. As I pointed out in my testimony, the technique of making tests in the laboratory does not precisely duplicate the agitation conditions which exist in the developing
719 machine during operation. We cannot expect such tests to agree precisely with tests obtained by actually running the sensitometer strips in and through the developing machine.

XQ491. To what extent did the results obtained from your test very with respect to the figures given in this statement? A. To what extent?

XQ492. Yes, namely, over-all gamma of 1.2 for picture and over-all gamma of 1 for the sound? A. These laboratory tests which were made chiefly to show character of development,
720 appear to give a development rate slightly lower than that obtained in the developing machine.

XQ493. State what it is, will you? A. I can only say that in 12 minutes development of the negative stock in the negative developer I obtained a gamma of .57, and the figures you refer to, assuming that the positive film is developed to a gamma of 2, would indicate that in the machine the defendant obtains a gamma of .6 instead of .57. A difference of .03.

XQ494. You stated that you were not hired or paid to testify as an expert here. You were just down as a favor to the Western Electric Company? A. I think you may regard it as that.

XQ495. Well, tell us just what the fact is. Why are you down here to testify? A. I was directed to do this work by my superior.

XQ496. Do you know Dr. Donald MacKenzie? A. Yes, I have met him on some occasions.

XQ497. Do you know what concern he is connected with? A. He is connected, I believe, with The Electrical Research Products or some—I am not sure whether it is that exact organization, but that group of organizations.

XQ498. Somewhere in the Western Electric 722
family? A. Yes.

XQ499. Is he one of their consulting engineers? A. I am not sure just what his title is. That sounds like a satisfactory title.

XQ500. Do you know whether he is president of the Hollywood Section of the Sound Motion Picture Engineers, or whatever they call themselves? A. I am not sure whether he is at the present time. I think he was elected to that office. I am not sure whether his term has expired or not.

XQ501. Do you regard him as a man of high 723
authority in the art of sound picture recording and reproducing? A. Yes, I have a very high regard for his ability.

XQ502. I refer you to an article of Dr. MacKenzie's, the same Donald MacKenzie, entitled "Straight Line and Toe Records with Light Valve," published in the Journal of the Society of Motion Picture Engineers, Volume 12, No. 2, the article commencing at page 172 of that volume, the volume being that of August, 1931, publisher's name, and so forth, eliminated, in which he discusses the Western Electric system,

and I read you the following from page 173, middle of the page:

> "The requirements of pictorial reproduction have been thoroughly discussed by L. A. Jones, who shows that faithful reproduction of brightness values is attained only when the overall gamma is unity, with the further restriction that negative exposure and positive printing
> 725 shall be confined to the straight line portions of the respective H and D curves. In practice it is common to use an overall gamma greater than unity and allow the positive print to intrude into the toe of the positive curve, for reasons depending on lens performance and conditions of screen illumination."

Do you agree with Dr. MacKenzie's statement here? A. Yes, in general. If I were going to discuss the statement, there are many things,
726 many factors which would have to be taken into consideration in order to answer that question fully. We know that there are many factors in the process of tone reproduction which we may consider to be of a second order which influence the overall gamma to which the positive must be made in order to obtain a precise reproduction of tone values. For instance, there are certain losses of contract due to the projecting system which must be compensated for.

The statement which I made which he refers to there I think is a perfectly valid one, and

in my publication on the subject, I point out specifically that all of the characteristics of the photographic materials, of the printing systems, of the projection systems, of the development of the positive and negative, must be known and measured under the practical conditions under which the materials are to be used. If those precautions are taken and an overall gamma of unity is obtained, and by that I mean an overall gamma of unity when comparing the reproduction with the original, then truthful render- 728
ing of tones of the object will be attained.

XQ503. I refer you to another article by the same Dr. MacKenzie entitled "Sound Recording with the Light Valve," commencing at page 730 of Transactions of the Society of Motion Picture Engineers, Volume 12, No. 35, Meetings of September 24-28, 1928, and I refer you particularly to the following paragraph near the bottom of page 737:

> "In 1924 we concluded that the optimum choice was positive emulsion de- 729
> veloped to unity gamma for both sound negative and sound print. This is feasible for sound records separate from pictures, but a compromise must be made for the combination of sound and picture in a single positive print. Here the positive development required for a satisfactory picture is always to a gamma far above unity."

Do you agree with Dr. MacKenzie? A. It depends entirely on what he means by "far". I know definitely that satisfactory reproduction

of pictures can be obtained by a gamma product of something over unity, perhaps 1.2. That is a reasonable value.

I should point out, perhaps, that in speaking of gamma, as we have been doing thus far we are speaking of gamma as measured diffusely. Now, the effective overall gamma of the picture projected, must be computed on the basis of the specular gamma of the positive material which is being projected. That, of
731 course, tends to give a compensation for certain contrast losses which we meet in the optical system.

XQ504. Do I understand you to mean by that profound language that you are using there that we have been talking about a different gamma from what Dr. MacKenzie has been talking about? Answer that question first, just yes or no. A. Only partially. I cannot answer that by yes or no, because we are talking about two gammas.

XQ505. Well, now, do I understand further
732 from your next to the last answer that what you are trying to point out is that the gamma of the picture we see on the screen necessarily differs from the gamma of the positive print from which it is projected, to some extent? A. I don't quite know what you mean by the gamma of the picture we see on the screen.

XQ506. Well, the contrast in the picture we see on the screen? A. Differs from—

XQ507. The contrast of the positive from which it was projected. Wasn't that what you were trying to bring out in that answer of yours just now? A. Yes, that is true.

XQ508. Then you ought not to have much trouble in understanding my question, should you? A. (No answer.)

XQ509. Now, following that up, was it not the intention of your said answer to point out that Dr. MacKenzie was probably talking about the contrast of that picture on the screen which he said must be far greater, whereas you were talking about the contrast on the positive, is that right? A. No, I don't think that is necessarily true.

XQ510. I am trying to find out in what way 734
you were qualifying, either intentionally or unintentionally—I am not casting any aspersions —in what way you were trying to qualify or reconcile some of your testimony with Dr. MacKenzie's statement. You said he had to use the words "far greater", and that he had— A. I am only trying to point out that in following through all of the computations we must go through in solving the tone reproduction problem, there are many, many things which have to be considered, many factors which have to be 735
considered, among which one is the difference between the contrast of the positive film as measured in a densitometer of the normal type and the effective contrast, as it is, let us say, measured, when it is being projected onto the screen, and that, furthermore, due to the characteristics of a projecting system, there is a certain lack of faithfulness, we will say, in the reproduction of the contrast of the positive on the screen.

Now, in trying to solve these problems by the tone reproduction method, we must consider

all of those facts. Now, it is difficult from the particular statement which Dr. MacKenzie has made to know exactly what he had in mind. That is the thing I am trying—

XQ511. How do you interpret his articles? Is he talking about the contrast of the picture on the screen or is he talking about the contrast of the film from which the picture is projected? A. I rather think, from the reading of that, that he is talking about the contrast
737 of the picture, of the film as projected.

XQ512. The contrast of the film? A. I think so.

XQ513. And that is precisely what you have been testifying about, is it not? A. Yes.

XQ514. All right. Then we finally get you and Dr. MacKenzie down on the same platform again. Now, if Dr. MacKenzie, by any stretch of the imagination, should have been talking about the contrast of the picture on the screen, I take it from your testimony here, that for a given contrast of the positive film from which
738 the picture is projected, you will have less contrast of the picture on the screen; isn't that right? A. Yes.

XQ515. So then, if Dr. MacKenzie should happen to have been talking about the contrast of the picture on the screen, his statement about gamma being far greater would be even more apart from your testimony; would it not? A. Yes, I think so, if he were talking about that particular characteristic—

XQ516. Now, perhaps you can tell us whether you consider the differences between a gamma of I and a gamma of 1.2, as 1.2 being far greater than 1? A. No, I do not.

XQ517. Then, in your opinion, Dr. MacKenzie was talking about a much greater difference than the difference between 1 and 1.2? A. My idea of what may be far greater may be entirely different than Dr. MacKenzie's.

XQ518. Do you know S. S. A. Watkins and C. H. Fetter? Do you know either of those men? A. No, sir, I do not.

XQ519. You never heard of them? A. No, I believe not. I cannot recall having heard of them.

740

XQ520. Don't you read these journals of the Society of Motion Picture— A. Yes, I read most of them. I don't read all of them.

XQ521. Don't you know that this man Watkins is a very prominent man in this art, have you never read any of his articles? A. I am afraid I missed that article.

XQ523. Have you ever read any of his articles? A. Not to my knowledge.

XQ524. And you don't know that he is connected with the Western Electric or any of its subsidiaries? A. No.

741

XQ525. I refer you to an article by said Watkins & Fetter, entitled "Some Aspects of Western Electric Sound Recording System," in the Journal of the Society of Motion Picture Engineers, Volume 4, No. 5, for May, 1930, and I read from page 524 the following paragraph:

> "Ordinarily in photographic work particularly for screen presentation, light values on the screen are quite different from those on the original picture. Due to limits in camera, in emulsion, and in pro-

> jection apparatus, it is usually necessary for pleasing effects to obtain in screen pictures far greater contrast than actually exists in the original object photographed."

Do you agree with that statement? A. No, I do not agree with the statement.

XQ527. Were you at the May meeting of the Society of Motion Picture Engineers in 1930?

743 A. Where was the meeting held?

XQ529. I refer you to an article written by Lloyd A. Jones and Clifton Tuttle; that Jones is you, is it not? A. Yes.

XQ530. Entitled "The Effect of Projection Lens Flare upon the Contrast of the Motion Picture Image," commencing at page 153 of the Transactions of the Society of Motion Picture Engineers, No. 25, Meeting of May 3-6, 1926, and to the following paragraphs, first the one commencing at the bottom of page 160:

744

> "When the picture is of low average density the effect of lens flare on contrast is very severe. When the subject is a seascape, close-up views of white buildings or bright landscapes containing a large amount of sky, the ideal contrast may be reduced to one-half or one-third of its value."

Is that correct? A. That is correct.

XQ531. Is that your testimony in this case? Do you affirm that as your testimony? A. The statement, I said the statement is correct.

XQ532. I say, do you accept that as your testimony in this case? I ask you if that is a correct statement of the facts? A. It is.

XQ534. And you accept that as your testimony in this case? A. Yes.

XQ535. I read you the following from page 162 of said article—I will first read from page 163, the fourth paragraph, under "Conclusions":

> "The effect of lens flare on quality of 746
> tone reproduction is to warp the shape of the reproduction curve and to depress the contrast."

Is that statement correct? A. Yes, it is correct.

XQ536. And I read you from page 162: "It is customary in practice to attempt to compensate for loss of contrast due to lens flare by increasing the time of development in making the positive, thus increasing the slope of the straight line portion," meaning straight line 747
portion of the curve, I assume. Is that a correct statement? A. I think it is correct if it is applied to certain practices. I wouldn't say that it is universally used in an attempt to correct.

XQ537. Mr. Jones, reverting again to the Journal of the Society of Motion Picture Engineers, Volume 14, containing the article of said Watkins and Fetter, did you say that you had never read that article? A. I believe I have never read that.

XQ538. Well, according to this publication

you are down here as editor *pro tem.* A. That may be perfectly true.

XQ539. And still you wouldn't have read the article over? A. Not necessarily; when I was editor of this Journal, I frequently referred articles which I felt that someone else was better able to criticize, to other people, and they were put in on that assumption, or on that basis.

XQ540. To come back to the place that meet-
749 ing was held, I find the spring meeting, according to the inside of the cover of this publication, it says: "The spring meeting was held at Washington, D. C. at the Wardman Park Hotel." Does that refresh your memory any? A. Yes, I attended that meeting, not all of the sessions, however. I think I was there two days of the sessions.

XQ541. And you do not remember whether this article was read in the two days that you were there? A. No.

XQ542. Referring back a moment to your
750 own article, a portion of which I have read to you, and the language used in your article, "thus increasing the slope of the straight line portion," that means increasing the overall gamma for the combined record, does it not? A. Yes.

XQ543. Now, Mr. Jones, isn't it a fact that these various extracts that I have read you from your own article all tend to point to the fact that the gamma of the picture should be substantially greater than the gamma of the sound which is supposed to be unity? A. I think it points certainly to the—it indicates that the gamma should be somewhat greater.

XQ544. Doesn't it do a great deal more than indicate? You go on and talk of loss of gamma by lens flare and what-not, and harp on it. Aren't you, as a scientific man, trying to inform your less experienced and educated followers in the art that they should have a gamma of the picture so great that when this gamma is dissipated or partly dissipated through lens flare and what-not, you should still get the desired contrast on the screen? A. Yes, it is a question of magnitude, as to how much you should raise that gamma. 752

XQ545. And isn't it true, to get the most faithful reproduction on the screen, image on the screen, of a particular object, that you should have unity gamma or contrast of the image on the screen? A. That is correct.

XQ546. And notwithstanding that, do you still maintain that this matter of a difference from a gamma of unity, of 1 and 1.2 is inconsequential, immaterial? A. The difference between 1 and 1.2?

XQ547. 1 and 1.2. A. Yes.

XQ548. Referring to that part of your article that I have been reading from at page 161, which says that the ideal contrast may be reduced to one-half or one-third of its value, would the corresponding variation to compensate for these differences in contrast be substantial or negligible? A. In those particular cases it probably would be substantial, but you must remember that that magnitude of reduction of contrast is only obtained with certain particular brightness distribution in the field. Under the average conditions of studio practice the reduc-

tion of contrast is not anything like as great as that ordinarily. In that paper we quoted some extreme examples.

XQ549. Pictures are taken out-of-doors every day, aren't they? A. Surely.

XQ550. Didn't I understand you to tell me that under your present practice it would not make any difference where a picture was taken, indoors or outdoors, the opening of the lens shutter is made so that the illumination was the
755 same on the picture? A. The exposure.

XQ551. Yes. That being true, isn't that article applicable to indoor work as well as outdoor work? A. Yes, it is.

XQ552. Then what difference are you trying to draw attention to by referring to indoor work? A. I am trying to point out that in making certain illustrative references in this article we referred to particular compositions in which the resulting contrast was abnormal, much greater than in, we will say, the average case. Frequently, in discussing any subject, it is illus-
756 trated by giving an extreme example.

XQ553. The fact, as I understand your testimony to be, that it is necessary to have the overall gamma of the picture on the positive film greater than unity or 1; is that the reason why defendant produces a picture positive with an overall gamma of 1.2 rather than 1? A. Yes, I believe it is.

XQ554. And yet you say that that difference between 1 and 1.2, a 20 per cent. difference, is inconsequential and hardly noticeable? A. That is the case, according to tests.

XQ555. And in your opinion, it has no ma-

teriality? A. It certainly has some effect, naturally. It is a question of magnitude.

XQ556. Now, perhaps you will tell me why they take such studied means of maintaining that difference if it doesn't amount to anything? A. They undoubtedly have found that that particular practice gives them satisfactory picture quality.

XQ557. Well, what does that mean? A. It means a quality on the screen which gives a pleasing and satisfactory reproduction of the 758
scene which has been photographed. It does not necessarily mean that that reproduction is a precise reproduction of the brightness distribution in the object.

XQ558. All right. If it is inconsequential, why don't they make it unity instead of 1.2? Why don't they get the pleasing effect with unity? A. They could get a very pleasing effect with unity, I think.

XQ559. You think. Do you know? A. Yes, I have made a picture using a gamma of unity, and I think the result was very satisfactory. 759

XQ560. Under the same conditions as exist in the studio? A. Not in their studio, but in other studios and outdoors.

XQ561. Did you make these personally? A. Yes, sir.

XQ562. Do you still maintain that this difference of 1 and 1.2 doesn't amount to anything at all? A. I do not say it does not amount to anything, I say it is not of appreciable importance. For instance, you can make two pictures, one having an overall gamma of unity, and the other having an overall gamma of 1.2, and

760 *Lloyd A. Jones—For Defendant—Cross.*

under favorable conditions, those can be detected.

XQ563. You have testified in answer to Q75 that according to defendant's process as given in defendant's statement, the sound and picture records are developed to "substantially the same contrast," and in answer to Q76, you stated that it is the usual practice in like films of straight line records, to develop them "to substantially the same contrast," and you fur-
761 ther testified, in answer to Q77, that the 20 per cent. difference in the overall gamma of defendant's sound and picture positives is inappreciable and that it was inappreciable with respect to the picture positive, and in Q77 that this variation of 20 per cent. in the sound record is inappreciable. That is a substantially correct statement of your testimony? A. I think so.

XQ564. I now refer you to an article of the same Dr. MacKenzie of the Western Electric family above mentioned in the transactions of
762 the Society of Motion Picture Engineers, Volume 12, No. 35, and read you the following from page 739, near the top of the page:

> "It has been calculated that if the overall gamma departs from unity by .2 in either direction, a harmonic of five per cent. amplitude in the fundamental will be introduced. Experimentation has shown that a five per cent. harmonic is the least detectable. We state then the tolerance on the overall gamma for the sound track at .8 to 1.2. Variation of a

corresponding amount in the contrast of the picture print is intolerable; therefore, greater latitude of contrast is permissible in the sound record than could be tolerated in the accompanying picture."

Do you agree or disagree with Dr. MacKenzie? A. I disagree.

XQ565. Very decidedly, I suppose? A. I disagree on his statement as to the picture.

XQ566. It is a flat contradiction of your testimony, is it not? Your testimony is a flat contradiction of Dr. MacKenzie's statement that I have read you, is it not? A. Relative to the picture. 764

XQ567. Relative to the picture contrast which you testified about and which he is talking about? A. Yes, I think it is.

XQ568. It so happens, does it not, that the variations Dr. MacKenzie is referring to here are the variations from unity or 1 to .8 or 1.2, that is right, isn't it? A. Yes, 1 plus or minus .2.

XQ569. In other words, a difference from unity of .2, a difference from unity of .2 either way? A. Yes, in overall gamma. 765

XQ570. And it so happens that that is exactly the difference that the defendant sets up in its statement, that is, a difference from 1 to 1.2, is it not? That is the difference they set up, is it not? You know that, 1 to 1.2. A. Yes.

XQ573. Can you tell us what is the relative cost of positive film stock used for defendant's sound negative as against the negative stock used for defendant's picture negative? A. No, I cannot tell you just what the difference is at

766 *Lloyd A. Jones—For Defendant—Cross.*

the present time. There have been some changes in the price at which those things are sold, and I am not in the selling end of the organization. I do not know at the present moment what the difference is.

XQ574. Which is the cheapest, do you know that? A. Positive film.

XQ575. No doubt about that? A. No.

XQ576. Would you say it is approximately a fourth as cheap, approximately one-fourth?
767 A. One-fourth or a third, or something of that order. I don't know the exact price at the present time.

XQ577. I believe you testified the positive stock had a finer grain characteristic, and you also testified that negative picture stock was intentionally developed slower for the purpose of producing a finer grain in that stock, is that right? A. I have testified that the positive stock has a finer grain than the negative stock, yes, sir.

XQ578. And did you also testify that the
768 negative picture stock was intentionally developed slower for the purpose of producing a finer grain in that stock? A. It is developed slower in order to give the sulphite an opportunity to act on the grain structure, yes.

XQ579. Now, my question was correct, was it not, to you? Answer that yes or no.

Mr. Neave: I object to that.

The Court: I will let him answer it if he remembers what he said.

A. Yes.

XQ580. Then as far as concerns the grain of the stock only, it would be desirable for the de-

fendant to use a positive stock for both the recording of the picture and the sound, is that right—so far as concerns the grain of the stock only? A. Yes.

XQ581. The positive stock being, as you say, a fourth to a third cheaper than the negative stock and having the desired fine-grained character, it would be desirable for the defendant to use the positive stock for sound and picture negatives, if there was sufficient light in the studio for exposing the positive stock which you 770
have testified was relatively slow-acting with respect to exposure, is that right? A. I think there are some other considerations that would have to be given in using a positive stock for making the picture; for instance, such questions as its latitude, its ability to render a picture of satisfactory quality.

XQ582. The negative stock? A. No, the positive stock. You asked about the positive stock?

XQ583. I did, yes. A. And I say that would require some consideration other than the mere fact that it is a slow, fine-grained material. We 771
would have to consider also its quality from the standpoint of its ability to render the picture satisfactorily.

XQ584. Don't you know its ability to render the pictures satisfactory or unsatisfactory? A. The material has a somewhat shorter latitude than negative material when the two are developed to the same gamma, the same contrast. That might be an objection to its use for the making of negatives.

XQ585. Do you consider that consequential? A. I think it is possible it is. I don't know. I

772 *Lloyd A. Jones For Defendant—Cross.*

have not considered that thing. The decision as to whether a particular photographic material is suitable for certain purposes requires some consideration.

XQ586. Well, now, let us get down to what you actually know. In your experience and the experience of your concern, you must have tried positive stock for pictures; certainly you have done that, have you not? A. Well, in a very limited way—for making negatives, you mean?

773 XQ587. Yes. You have tried it a great deal for making positives, have you not? A. Yes, sir.

XQ588. And your experience in making positive gives you a right to decide certain factors about the making of negatives, does it not? A. Certain factors. I don't think it necessarily gives the information required to decide all factors.

XQ589. With this stock being about 1 to 4 or 1 to 3 with respect to negative stock in cheapness, and having the fine-grained charac-

774 teristics that you say are desirable both for picture and for sound, do you mean to say that it has never been investigated whether that positive stock could be used for negative picture-taking? A. I think it has been investigated to a certain extent.

XQ590. Quite thoroughly, has it not? A. I don't know what you mean by "thoroughly." Certainly some experiments have been made.

XQ591. I guess you and I won't agree on qualifying words ever; but very carefully, and so that a pretty definite conclusion has been reached? A. Yes, we will admit that.

XQ592. Now, the real reason why it is not used is the reason that I give in this question, is it not, that it does not— A. That it is slow.

XQ593. That it is too slow? A. Yes, that is right.

XQ594. That is the real practical reason? A. Yes.

XQ595. That is, if it was used for negative stock with the illumination available in these studios, you would get under-exposure? A. Yes.

XQ596. And you have testified at pages 266- 776
267, in substance, that it almost essential for making negatives in studios, meaning picture negatives, where it is not possible to light the scene sufficiently, to use a negative stock which is very sensitive to light, is that right? A. Yes.

XQ597. As I understand your testimony, you have testified at page 268 that defendant uses positive stock for sound negatives because there is plenty of light in the sound-recording camera to give adequate exposure, is that right? A. Yes.

XQ598. Then defendant uses the negative 777
stock for pictures to avoid under-exposure of the picture negative under its lighting conditions, and having done that, they are forced to use separate development of this picture negative and the corresponding sound negative on positive stock to get desired contrast in each; isn't that a correct statement? A. Yes, to get the desired contrast in each.

XQ599. Then in defendant's process, to cure the difficulty arising from using different lighting conditions in photographing the picture and sound negatives, the defendant uses different

778 *Lloyd A. Jones—For Defendant—Cross.*

films stock for the second and picture negatives and separate development treatments, is that right? A. Yes.

XQ600. In answer to a leading question, you testified at page 268, Q50, that you found no mention in the patent in suit about using a different kind of stock for the sound negative film, as compared with the picture negative film. Do you find it stated anywhere in the patent that the process is to be limited to the use of the
779 same stock for pictures and sound, or that the process is only applicable where the same stock is used for the picture and sound negatives? A. That is not thus specifically stated.

XQ601. No statement at all about it, is there? A. There is no statement, but it speaks specifically of recording the sound and picture on the same strip of film.

XQ602. As the old practice, and the modification where the two are secured together and then separated; right? A. Yes, that is correct. We certainly would conclude from that that
780 they were contemplating the use of the same photographic emulsions.

XQ603. In those two cases? A. Yes.

XQ604. Now, with respect to the particular difficulty pointed out by the patentees, which is one difficulty that the process takes care of, *i. e.*, different lighting conditions in exposing the picture film and the sound film, you will get a latent image in the picture film which, if you develop that negative exactly as you do the sound negative, it will result in an undesirable contrast for the picture record, is that right? A. The patent, as far as I can see, states noth-

ing about differences in exposure between the sound and the picture negatives. It speaks of differences in exposures of different scenes or takes of the picture negative itself, and it is directed toward a method of correcting those difficulties.

XQ605. Well, now, bringing in that statement of yours and qualifying my question with it, if you please, will you now answer my question: that is, you get under the patent a latent image in the picture film which, if you develop that 782
negative exactly as you do the sound negative, it will result in an undesirable contrast for the picture record, will it not? A. It would in some cases, depending upon exposure in the negative—

XQ606. Mr. Jones, would it not in the case where the picture is over exposed or under exposed? A. Yes.

XQ607. That is the only thing the patent is talking about, from your own testimony: is that right? A. Yes.

XQ608. So you do get this latent condition 783
then? A. Yes.

XQ609. Now, with respect to defendant's process, when you have exposed the sound film and the picture film on their respective film stocks, as defendant does with the lights it uses for picture and for sound recording, you will get a latent image on the picture film, which, if you develop that picture negative exactly as you do the sound negative, it will result in an undesirable contrast for the picture: is that right? A. That is true, because the two stocks are different, the two photographic stocks are different. They have different characteristics.

784 *Lloyd A. Jones—For Defendant—Cross.*

XQ610. And because the lighting of the sound and the negative picture are different, under your own testimony? A. Well, naturally they are different, because they are recorded in entirely different manners. One is a picture and the other is a sound record.

XQ611. Then, there is nothing wrong with the question that I have put to you, is there, which brings in those two factors? A. No.

XQ612. Have you obtained the negatives that
785 I asked for from which the photographs, Defendant's Exhibits D and E were made, and which you said you would probably have here by yesterday? A. Yes, they were obtained.

XQ613. Notwithstanding the reasons you have given for defendant using the process that it uses in making its positive sound picture records, it is a fact, is it not, that it does produce on a single sensitized film sound sequences and picture sequences longitudinally arranged side by side on the same face of the same sensitized film, and that in obtaining such a positive film,
786 the sound sequence is photographed on one film and the picture sequence is simultaneously photographed on another film, and that these two negative films are separately developed in a manner suitable for each, and are then successively printed on the positive film? A. Yes.

XQ614. With regard to the Walker patent, is it not a fact that, except in the modification where Walker proposes to obtain an enlarged sound record on his picture record, his disclosure is nothing more than the old system referred to by the patentees of the patent in suit, wherein there is a single negative on which the sound and pictures are taken, and which is developed as such, that is, while both are on the same film,

i. e., no separate development, and from which the sound and picture records are then printed onto a single positive? A. Yes, with the exception of the other form—

XQ615. I am coming to that now. And then commencing at line 40 of page 3 of Walker, he describes a modification or additional feature, wherein, in order to get an enlarged sound record on his picture film, he takes his negative record containing the combined sound and picture negatives and he prints onto a positive film 788 the picture sequence and then by a photographically enlarging system, he prints from that same negative carrying the sound and pictures, the enlarged sound record upon the positive onto which the picture record was printed from said negative, is that correct? A. Yes, that is correct.

XQ616. In neither of the alternative methods suggested by Walker does Walker separately develop or have any opportunity for separate development of the negatives: is that right? A. That is correct.

XQ617. And the Walker process is not the 789 process used by the defendant? A. No.

XQ618. What emulsions were ordinarily used on positive and negative motion picture films 20 years ago? A. The emulsion used on positive films is substantially the same as that used at the present time, a low-speed fine-grained high-contrast emulsion—

XQ619. What base, silver or what? A. I did not understand that last question.

XQ620. Silver bromide emulsion or what? A. A silver halide emulsion.

Mr. Neave: You did not finish your answer, Mr. Jones.

790 *Lloyd A. Jones—For Defendant—Cross.*

The Witness: The negative emulsion was a relatively high-speed type, but not sensitive to all of the colors, such as the present panchromatic emulsion. Aside from the difference in color sensitivities, practically the same as that used now, although, of course, certain improvements have been made in the course of that time.

XQ621. Silver halide? A. Silver halide.

791 XQ622. Why does Craig—referring to the Craig patent—why does Craig disclose the use of infrared rays for projecting his sound record, rather than ordinary light? A. One of the forms disclosed by Craig involves the printing of the sound records on the opposite face of the positive film. In order that that record should not interfere with the picture record, it is necessary to make it transparent to visible light, and in order to obtain the sound modulation he must make the differences in density in a part of the spectrum to which the eye is not sensitive.

792 XQ623. Boiling that down to a few words, the fact is that Craig resorts to this attempted expediency in order that the projection of his pictures which occupy the front face of the film will not be interfered with by his sound record, which occupies the back of the film: is that right? A. Yes, that is correct.

XQ624. Mr. Neave read you from the Craig specification where it stated, line 113 to 120, at page 4:

"It will be noted from what has gone before that so far the negative of the sound record and the negative of the pic-

ture record have been made upon separate strips or films. It is necessary, therefore, that these two negatives should be photographically printed upon one film or upon opposite sides thereof."

You testified that this language indicated to you that Craig contemplated printing the sound and picture records onto the same film and either upon the same face of the same film or upon opposite faces. Did you mean by that that Craig suggested putting the sound record and the pic- 794
ture record side by side on different portions of the same film or merely that he would have the two records, sound and picture, superimposed one on top of the other on the same side of the same film by the same kind of double emulsion layers—by some kind of double emulsion layers? A. Well, he did not suggest either of the alternatives you mentioned, but the language to me clearly indicates that he at least thought of printing the two records on either the same face or the opposite faces. Now, just how, he does not specify.

795

XQ625. Well, now, can you tell me what you mean by your last, that Craig does not suggest it, suggest that he would do this, but that you infer that he would do it from what he said? A. No, I inferred from the language that he had thought of the possibility of doing it. The fact that he said they can be printed upon one film or upon opposite faces to me means that—

The Court: That quotation was from lines 113 to 120.

A. (Continuing.) He at least thought of printing them onto the same face, but for reasons of

796 *Lloyd A. Jones—For Defendant—Cross.*

his own, which he explains to a certain extent, attempts to put them on opposite faces.

XQ626. Now, I ask you where you get your justification for your statement that you infer that he suggested putting them on the same face? A. The only justification is in this language in this particular quotation.

XQ627. And the entire Craig specification is to the contrary, aside from those three or four words, is it not? A. Well, the preferred forms
797 he shows are to the contrary.

XQ628. Every form he shows is to the contrary? A. That is quite right.

XQ629. Every form he describes how to go about it or make is to the contrary? A. Yes, that is correct.

XQ630. The whole purport and tenor of his specification and disclosure is the idea of how to use two overlying records, sound on picture, overlying records, so that one will not interfere with the other, is that right? A. Yes, all of his disclosures, of his forms suggested for doing it,
798 relate to that thing.

XQ631. And do you think it is a fair statement to say that this language, "printed upon one film or upon opposite sides thereof", would convey to you, in the light of Craig's specification, that Craig was teaching the printing or suggesting the printing of the sound and picture on the same side of the same film, or do you think that the more natural or proper interpretation would be upon one film, *i. e.,* upon opposite sides thereof? A. I do not consider that the last statement, replacing "or" by "*i. e.*" is justified; it seems to me that that changes the sense of the sentence.

XQ632. Isn't it on the same film when it is on opposite sides? A. Surely; it is also on the same film when it is on the same face. 799

XQ633. Then, because he uses in those few lines a generic location, then a specific one with "or" between, you want to tell the Court that you think that should be interpreted as pointing to two specific ways of doing it? A. The possibility of two specific ways.

XQ634. The possibility of two specific ways? A. Yes.

XQ635. If you were reading this Craig specification, Mr. Jones, before you were employed as an expert in this suit, and reading it with a view of having before you the patent in suit, do you think you should have paid any attention to that? A. I think I should have interpreted that sentence just as I have. 800

XQ636. I direct your attention to page 2 of the Craig patent commencing at line 34 to line 50, which reads as follows:

> "A further object is to provide mechanism whereby the sounds may be recorded upon the picture carrying film of moving picture machines and reproduced therefrom, this film being so formed that the picture record and the sound record may overlie each other without the sound record interfering with the picture record, or vice versa. 801
>
> "A further object of the invention is to so form the film that the picture record may be taken in the ordinary manner and printed photographically upon one side or face of the film while the sound record may

802 *Lloyd A. Jones—For Defendant—Cross.*

be taken photographically and printed upon the other face of the film."

That is page 2 of Craig, No. 1,260,337, commencing at line 34.

You do not find in those objects of invention any suggestion other than that the two records should overlie each other, do you? A. No.

XQ637. And it is expressly stated that they should, is that right? A. Yes.

803 XQ638. On page 2 at line 58 it is stated: "A further object is to form a sound record upon a film capable of transmitting light, this sound record being formed by material which is pervious to ordinary white light but which is impervious to or affects the transmission of infra-red rays."

That again refers to overlying film conditions, does it not? A. Yes, that is correct.

XQ639. And to nothing else. I refer you to page 2, line 125, the second column, near the bottom of the page: "My invention is based upon
804 the fact that infra-red rays are invisible but that these rays will affect a properly sensitized photographic film." That again is directed entirely to this idea of overlying sound and picture films, is it not? A. Yes.

XQ640. I direct your attention to page 7, line 69: "The two main features of my invention upon which the invention is based are in the first place the provision of a film capable of receiving not only the photographic prints of the pictures to be projected, but also the photographic record of the sound and the use with these films of invisible rays for the purpose of reproducing the sound record."

This again is directed to the overlying sound and picture records only, is that right? A. Yes, I should think so.

XQ641. Have you looked at Craig's claims? A. Yes, I have.

XQ642. Is it not a fact that practically all of the claims are limited specifically to records being in overlapped relation? A. Yes; that is the case.

XQ643. Notwithstanding all those statements in Craig you still maintain that the interpreta- 806
tion you placed on those words is a proper interpretation? A. I think that is the case. It is certainly, in the claims the object of the invention is not the recording on the same face, but I feel that it constitutes a disclosure of the general idea of printing two records onto the same film.

XQ644. I never disputed that with you, that I know of, or asked you any question as broad as that. A. Well, I think further it constitutes a suggestion or disclosure of printing two records onto the same face of the film. 807

XQ645. And you still adhere to that conviction? A. Yes, that is my interpretation. It seems to me that is a suggestion definitely disclosing that idea.

XQ646. Mr. Jones, in your opinion could anyone take the Craig patent and following his instructions there make an overlying non-interfering sound and picture record? A. Not following his instructions in detail, but following the idea in general, I think it is quite possible.

XQ647. When you say that you mean following the broad idea of producing overlying pictures— A. The broad idea disclosed by Craig.

XQ648. You mean the broad idea of producing pictures and sound records? A. I mean something more than that. I mean the idea of producing overlying pictures and records in a manner as disclosed by Craig, that is, the use of invisible radiation.

XQ649. Invisible radiation for the sound? A. For the sound, yes.

XQ650. And visible radiation— A. Visible radiation for the picture.

809 XQ651. And when you get beyond that broad suggestion of the Craig patent, his disclosures and recommendations are quite impossible, are they not? A. No, some of his disclosures are quite definite and very suggestive and leading, of methods which may be developed for accomplishing that. He discloses, for instance, certain definite classes of materials which would be useful or operative in carrying out the idea.

XQ652. We will come to some of those in a minute. I refer you to page 3 of Craig, lines 30 to 40, where he states: "Many substances will
810 cut off visible light entirely but will let the infra-red rays pass nearly perfectly. Vulcanite, iodin, bromin and many other substances will permit the passage of these infra-red rays and more or less completely intercept the visible rays. Many substances, such as alum, cupric chlorid, water, oxygen, carbonic acid gas, very thin metallic silver and selenite will, on the contrary, permit the passage of visible or white light but will cut off more or less the passage of the infra-red rays."

Among the substances mentioned as being suitable for use in forming the sound record are alum, cupric chlorid, water, oxygen, carbonic acid, and very thin metallic silver and selenite.

Will you please explain how a sound record can be made using water as a recording material? A. Using water as such, I do not think it could be used, but using it in the form of water of crystallization is quite a different matter.

XQ653. Water what? A. Water of crystallization.

XQ654. That isn't what he says. A. He mentions that in another place.

XQ655. What about alum? A. Alum begins to absorb in the infra-red region at fairly long wave 812
lengths, pretty well out of the visible spectrum. Its absorption is probably due to water of crystallization in the alum.

XQ656. It is not satisfactory for that purpose, is it? A. Not particularly.

XQ657. Not at all from any practical standpoint, using it as Craig intended to use it here to reproduce sound by infra-red rays and shoot the picture light through the same emulsion? A. I am not sure that that statement is correct, because alum, while it is not a good absorber in what we call the near infra-red region, further 813
out in the infra-red, where it is perfectly easy to get plenty of radiation, it has quite an appreciable absorption value.

XQ658. You wouldn't like to put out a film made of that, would you? A. I do not think I would choose that particular thing.

XQ659. What about oxygen, a nebulous suggestion, no good? A. Correct.

XQ660. What about carbonic acid gas? A. Not practical.

XQ661. What about cupric chlorid? A. Cupric chlorid has possibilities.

XQ662. Not a very practical proposition, is it?

814 *Lloyd A. Jones—For Defendant—Cross.*

You wouldn't like to be in the business of manufacturing and selling such stock, would you ? A. I do not know that there is any particular objection to that; it has fairly satisfactory selective absorbing characteristics.

XQ663. From a purely technical standpoint? A. Yes.

XQ664. What about this transparent metallic silver and selenite; selenite is crystallized gypsum, is it not? A. Yes, I believe so.

815 XQ665. And when powdered it becomes opaque? A. Well, it becomes opaque when the powder is observed in the normal manner, but if that powder were immersed in a medium such as a lacquer or varnish having the same refractive index, it wouldn't be opaque.

XQ666. What have you got to say about the selenite? A. I do not think it is very practical.

XQ667. The patent states, page 3, line 64; "One of the substances which would permit visible light to pass but which is opaque or impervious to the infra-red rays is very thin metallic
816 silver." Can you describe just how an emulsion is to be formed with such a thin metallic silver which is transparent to visible light and not to infra-red rays? A. As a matter if fact, metallic silver in thin layers is not satisfactory for use; I would not attempt to use it.

XQ668. So we can drop that without going any further on it. Craig says, at page 3, line 54: "For the visible light picture record, there are many photographic prints (such as most any of the present forms of positive prints) which would interfere not at all with the passage of the infra-red rays, and it is therefore only necessary to provide a proper transparent coating on the strip

or film which will intercept more or less the infra-red rays and yet will not affect the passage of the rays of white light."

Will you please state what were "most any of the present forms of positive prints" which Craig refers to and which at that time would be *completely* transparent to infra-red rays? A. I do not know of anything that would be completely transparent to infra-red rays, but that is not necessary for the operation of the idea. It is only necessary that we have a sufficient selective absorption within the region in order to obtain the 818
desired modulation of the infra-red radiation.

XQ669. Were those film stocks silver film stocks? A. I assume that he is referring here to the ordinary print in metallic silver. There may have been other forms available at that time, such as dye-image prints, which he may have had in mind.

XQ670. And very thin metallic silver happens to be the very thing that Craig refers to as being impervious to the infra-red rays? A. Well, the question of the absorption of very thin metallic silver, and a developed silver image, are very 819
unrelated subjects. Metals in massive form have very different absorptive characteristics than when present in the finely-divided powdery coke-like mass which forms a developed silver image. We cannot draw direct comparison as to the transmission of one from data on the transmission of the other. As a matter of fact, in some cases they have very opposite characteristics. It depends upon the state in which that metal is present.

XQ671. You have testified that Craig shows two sound records printed on the same side of

the positive film alongside of each other. Is it not a fact that Craig teaches that when he uses a film like that shown in Fig. 8 with two sound records placed in parallel position on the film, that that is done for the purpose of producing a dialogue between two parties whose images, or picture images, are to be printed on opposite sides of that film so as to overlie the sound record? A. Yes, the two records are printed both overlying the picture record.

821 XQ672. And that is shown quite clearly in Fig. 8 of the divisional Craig patent, 1,260,338, where there are the two pictures, or the pictures of two parties completely overlying those two records, sound records, is that not so? A. I cannot say that from here.

(Mr. Ward hands Craig divisional patent 1,260,338 to witness.)

A. Yes, that is the case.

XQ673. Does Craig show or describe anywhere a sound and picture record on a single film where the sound and picture records do not overlie each
822 other so that they interfere one with the other if ordinary light was used to reproduce both? A. No.

XQ674. If Craig is at all operative as a commercial proposition, which I think we both have doubts on, how much would it cost, considering labor, time and material, to produce Craig's composite sound picture positive as compared to the cost of the sound and picture record produced according to the patentee's or defendant's method? A. I haven't the slightest idea.

XQ675. It would be very much greater in the case of Craig, would it not? A. Not necessarily.

XQ676. At page 309 of your testimony Mr. Neave stated on the record that the patentees in prosecuting their application for patent "apparently endeavored to distinguish this patent from their alleged invention," stating "that Craig's only object in making the two negatives on separate films was apparently convenience, in that he wanted to print on opposite sides of a positive film, and it would be easier to do that when the sound and picture records were on separate films."

Then Mr. Neave asked you if that statement 824
which I have just quoted was justified, in your opinion, and you answered "No, it is not." Then you were asked, "Why not?" and you answered, "Because Craig's chief object in doing as disclosed in this patent is to obtain the record so they do not interfere with each other, preserving the full width of the film for the picture and obtaining a wide sound record."

Now, I assume that in giving that answer you gave it with the understanding that you were testifying that the statement made by the pat- 825
entees which Mr. Neave read to you was an incorrect statement, is that right, namely, that you didn't agree with it? A. That I didn't agree, yes.

XQ677. Now will you please point out the difference between the purport and substance of the statement Mr. Neave read to you and your answer with respect to the reasons? A. It seems to me in my answer I pointed out that one of the Craig reasons for wishing to print on opposite sides was to preserve the full width of the film for the picture record.

XQ678. And the object in making the two neg-

atives in Craig is for the purpose of printing on the opposite sides, isn't that it? A. And he wishes to do that in order to have a full-size picture area.

XQ679. Then the difference you seek to draw is that he did it because he wanted to print on both sides, and that he wanted to print on both sides in your opinion, because he wanted to preserve a full field for his picture? A. Yes, in what he was trying to do, in the process he was
827 attempting to operate, he wanted to print on opposite sides.

XQ680. With reference to the Pedersen British patent, at page 314, Q166, commencing on page 314, you were asked, "Are those separate records," referring to the Pedersen records, "printed on the same positive film." And you answered: "Yes, they are." Now, in that Pedersen process, the wavy line sound record is not printed on the film at all in any photographic sense, but is merely mechanically embossed upon the surface of the picture film? A. That is a photo-
828 mechanical process, yes.

XQ681. You didn't mean to use that word "print" in the sense of any photographing printing operation? A. No, it is a printing operation, it is not photographic printing, it is embossing.

XQ682. Simple emboss with a curved stylus on the record? A. Embossing, which is a printing operation but not a photographic printing.

XQ683. And at page 315, Q167, you testify that the sound record, after having been printed on the thin metallic strip is developed by special technique of a photo-mechanical nature. You did not mean by your choice of the word "develop" to suggest to the Court that there was any de-

velopment of the sound wave on the metal strip in the sense of a photographic development, did you? A. That term "development" of a bichromate gelatine or bichromate fish glue by the application of hot water or warm water is quite common. They speak, for instance, of developing a carbon print by brushing it or spraying it with warm water. It is not a development process in which a reducing agent is used which develops a latent image. That is perfectly correct.

XQ684. The particular language in the specification to which your term or word "develop" 830 is directed is the following statement: "The latter," meaning the wave line that is then formed, "is then washed out in a warm water bath until the metallic subground appears." A. That is correct.

XQ685. That is a mere water washing process? A. That is washing with warm water and it is the process which in the gum bichromate and bichromate gelatine process is referred to as development.

XQ686. Or as fixing? A. No, it is referred to as the development of a print in those processes 831 using bichromate gelatine.

XQ687. But it is not at all developed in the sense that the patent in suit uses it? A. No.

XQ688. You were asked at Q168, referring to Pedersen, if there were "Two different kinds of treatment for the two records," and you answered, "Yes." You do not mean, do you, to suggest by answering "Yes," to those words that were put in your mouth, that there were different treatments or developments of the negative records? A. No. By "negative records," you mean the photograph images formed on the original film—

832 *Lloyd A. Jones—For Defendant—Cross.*

XQ689. Yes. A. —of sound and picture. There is no differential development for those two particular records.

XQ690. As a matter of fact, the negatives in Pedersen of sound and picture are in a single film strip, are they not? A. That is correct.

XQ691. And that strip is developed with those two records, sound and picture, as a unity? A. Yes.

XQ692. Just as the old process was that the
833 patentees referred to in the first part of their specification, sound and picture carried on the same film and developed as a unity? A. Yes.

XQ693. Still referring to the Pedersen patent, you were asked at 169:

"Are these two records printed consecutively or simultaneously on the same positive film." And you answered they were printed consecutively. You did not mean, by adopting those words put to you, to give the suggestion that the sound record was printed in any photographic sense? A. As I have already stated, that is a
834 photo-mechanical printing.

XQ694. This is another part of this Pedersen patent we are talking about now, as I understand it. In each case, it is not the photographic printing that we were talking of? A. It is a photo-mechanical printing, an embossing operation.

XQ695. At Q170, you were asked with respect to this same patent: "Is it done on two positive films of different character or of the same character?" Referring to getting the sound record and the picture record on the same positive film, and you answered, "It is all of the same character in the positive film." Now, why did you use that word "character" there, "the same charac-

ter'' in the positive film? A. I meant only to say that the positive film was of the ordinary type and with the emulsion on the one face all of the same type, and the sound embossed in the cellulose nitrate part, the base.

XQ696. Yes, but at 169—it seems to me these questions are rather pointed—at 169, it says, ''Are the two records,'' referring to Pedersen's, ''printed consecutively or simultaneously on the same positive film,'' and then at 170, it says, ''is it done''—that is, for that printing of the sound 836 and picture record—''Is it done on two positive films of different character or of the same character?'' And you answered: ''It is all of the same character in the positive film?'' Now, as a matter of fact, in Pedersen, the sound wave is embossed on the back of the film, is it not? A. Yes, that is correct.

XQ697. And the picture print is on the front or emulsion side? A. That is right.

XQ698. Then what right have you to use the terms ''It is all of the same character in the positive film'' in answer to the question— A. The answer was meant merely to indicate that it 837 was printed on the usual positive film, which is of the usual character. It is all of the same character. Of course, it has two faces, one of which is coated with the emulsion and the other is the base. I don't—

XQ699. You defined ''character of film'' very definitely in your testimony, did you not? A. Character of a photographic material.

XQ700. Character of film you have defined pretty definitely, have you not, in your testimony? A. I have defined the character, the photographic characteristics of the material, yes.

838 *Lloyd A. Jones--For Defendant—Cross.*

XQ701. As I remember it, it was one which had substantially the same grain structure or granular structure? A. (No answer.)

XQ702. And you had reference to the emulsion, did you or of the film stock itself? A. To the emulsion.

XQ703. To the emulsion? A. To the photographic emulsion.

XQ704. And when you have been referring to positive film of the same character heretofore in
839 the patent in suit and defendant's process, you were referring to film having an emulsion of the same character, were you not? A. That is correct.

XQ705. And you use, or so it happens, that those same terms are used in these questions where you knew that the sound stylus record was embossed on the rear of the positive sound stock where there was no emulsion, is that right? A. Perfectly true. I did not intend to convey any meaning—the impression that the sound record was embossed in the emulsion.

840 XQ706. At page 316, Q172, still referring to this patent, this Pedersen patent, you were asked, "Will you tell me whether or not, the cellulose base of positive film is a suitable medium on which to print a sound record of the phonographic type, such as Pedersen," and you answered, "Yes, it is a very suitable record." A. That should be material. That is an error. It should be material.

XQ707. "—very suitable material for use in the embossing type of printing which is required in making this type of phonographic record." Surely, you did not intend to suggest to the Court that a satisfactory stylus type of record of this

type could be embossed in a motion picture film stock, ordinary stock used for motion picture films? A. In the material made—the base on which the emulsion was coated?

XQ708. No, on the very film stock carrying the picture? A. No, that was never intended.

XQ708a. You never intended to suggest that this was an operating proposition? A. Not for embossing in the emulsion, the photographic material.

XQ709. Or on the back? A. Yes, it can be 842 embossed on the back of ordinary photographic material.

XQ710. It can be? A. And that the base on which the emulsion is coated is a suitable material for such an embossing operation.

XQ711. Having reference to the thickness of the motion picture stock, you can satisfactorily emboss the wavy stylus record on the back of that to get satisfactory results? A. I say you can get very satisfactory results.

XQ712. Without putting anything else on the cellulose? A. Yes.

XQ713. Did you, on this point, did you know 843 that on page 2 of the Pedersen specification, commencing at line 32, he states:

"If the celluloid of the positive film be found unsuitable for the impressing of the sound wave line it may be necessary to make the impression on some other suitable substance."

Did you notice that? Mr. Pedersen had some doubt as to whether that could be satisfactorily done, did he not? A. Yes, he said "if".

XQ714. Referring to the Greenfelder patent, on page 316, at Q175, referring to the recording of the Greenfelder sound marks, you answered:

844 *Lloyd A. Jones—For Defendant—Cross.*

"Greenfelder makes a sound record by photographing sound marks on a negative film. These marks are made by the actuation electromagnetically of diaphragms which cause the light to act upon the film from time to time."

Now, in sound recording, in the proper sense of the word, as the defendant and the patentees propose to record, sound records, in a broad sense, are made by actuating electromagnetically diaphragms which cause the light to act on the
845 film? A. Yes, broadly speaking.

XQ715. Where do you find any justification for using that expression with respect to Greenfelder? I refer you to Fig. 7 of Greenfelder, which discloses, as I understand it, the manner in which he proposes to record his sound.

A. The answer to the question as I gave it in direct testimony was inadvertently incorrect. I should have stated, instead of "electromagnetically", "mechanically operated diaphragm."

XQ717. I see. And where do you get any justification for the word "diaphragm," even? A.
846 Well, the element 25, 24, and 25, as shown acts as a diaphragm which permits the light to pass through to the camera or not, whether it is in the upper position or lower position.

XQ718. Will you define the word "diaphragm"? A. I think broadly speaking it is a shutter, something for occluding the light rays, either partially or wholly.

XQ718. And the word "shutter" or light opening would be decidedly a more appropriate expression, would it not, with respect to Greensfelder? A. I have no objection to the term "shutter". In my own mind the word "diaphragm" is applicable to the form as shown.

XQ720. If you were writing a technical paper, would you use the word "diaphragm" in describing that operation of Greensfelder? A. Yes, I think I might. It is perfectly good phraseology in describing that sort of structure.

XQ721. Referring to the facts in regard to Greensfelder's proposed recording, the fact is that he proposes to connect up by a series of levers with his piano key, or each of his piano keys, let us take one, with his piano key, an upright arm with a slot cut in it, and he proposes 848
a constantly burning light projecting its rays at that slot or at the position that slot may occur, and then when the piano key 17 is struck, the arm or slab moves up and brings a slot or opening in that arm or slot before the light, so the light passes through the opening, and that light is projected onto the film: is that right? A. That is correct.

XQ722. And the type of record that Greensfelder there made, the type of shape of image that will be recorded will be in accordance with the mechanical outline of the shape of that slot? 849
A. Yes, that is correct.

XQ723. If that slot were an oval slot, you would get an oval image on your film: right? A. Yes, that is correct.

XQ724. And if it were a rectangular opening, you would get a rectangular image on your film? A. That is correct.

XQ. And there is no relation, is there, between the character or shape of that image on the film, with respect to the sound that Greensfelder hopes to be able to control through means of photographing that image on the screen, is there? A. No, that is perfectly true.

850 *Lloyd A. Jones—For Defendant—Cross.*

XQ726. All he wants to do is to have some opening, immaterial what the shape is, through which light will pass and register on a film: right? A. Yes.

XQ727. In Q176, commencing on page 316, you were asked: "The picture record is taken on one negative, is it not? A. The pictures are recorder on one strip of negative film, and the sound records are recorded on another length of negative film separately."

851 Now, with regard to the term "sound records", you mean the sound marks, as Greensfelder calls it? A. Yes, I mean the sound marks as disclosed in the patent.

XQ728, Arbitrary sound marks, having no relation to the variations of sound vibrations which we get in recording sound? A. They are arbitrary as far as shape. Of course they have a certain definite position on the film, which determines what they will reproduce when they go through the reproducer.

XQ729. And except for the matter of position,
852 they bear no relation to the original sound which is produced to accompany the picture? A. That is correct.

XQ730. Greensfelder proposes to reproduce his sound, his original sound, by setting up on the stage where the picture is projected a similar piano, if the sound is taken by playing a piano, and then, through a selenium cell mechanism arrangement, have light rays fall upon the selenium cell and create a current in a system of circuits which will cause a magnet to operate the corresponding key of a piano if and when that corresponding piano is put in position, is that right? A. Yes, that is right.

XQ731. And if you happen to put a bass drum on the stage and have that magnet operate the drum stick, you would get a drum beat instead of a piano key? A. That is perfectly true. If you do not assemble the equipment in the proper position, you will naturally get errors.

XQ732. But in true sound recording, that condition or that opportunity of mishap does not come in. When you properly take sound records such as the defendant and the plaintiff contemplate, so that when you put your light through it, 854
by reason of the character of the sound record, you get the faithful reproduction of the original sound? A. That is the case.

XQ733. With regard to this same point of the character of Greensfelder's photographed sound marks, you were asked at page 320, Q186:

"Let me ask you, Mr. Jones, could any advantage be obtained by developing the sound and picture records of the Greensfelder patent differently? A. Yes, there could be certain advantages obtained by doing that. The sound marks, of course, should be developed to a high 855
density, but at the same time not sufficiently high to cause any undue spreading of the image. If an exposed negative is forced in developing, fine lines tend to become wider. It might be very undesirable in the case of a record of this kind, so the sound negative record should have a proper development treatment."

Now, Mr. Jones, you realize that Greensfelder, in Greensfelder we are not dealing with the fine gradations of 70 or 80 lines to a fraction of an inch. We are dealing with pretty coarse lines, are we not? A. Relatively coarse. If he sets up, for instance, 88 operating mechanisms to record

on a single strip of standard film, there would be at least 88 and probably a few more in a distance of an inch across the film.

XQ734. 88 on the same horizontal line across the film? A. Yes, that would be necessary in his structure if he were going to operate a piano.

XQ735. Now, those are pretty coarse lines, as a matter of fact, are they not? A. They are relatively coarse as compared with a finer structure.

XQ736. And is it not a fact, Mr. Jones, that all
857 that Greensfelder cares about is to have a sufficient translucent opening on his film to let sufficient light rays through to activate the selenium cell? A. That is perfectly true, but he must not get through one particular opening enough light rays to actuate the next adjacent instrument, instrumentality, key, note of the piano.

XQ737. How wide would his slot have to be to do that? A. Well,—

XQ738. He proposes to use a separate selenium cell for each key? A. Yes,—

XQ379. Or a selenium cell made up into divi-
858 sions of compartments, one for each key, is that right? A. Yes, that is true.

XQ740. Now, the only thing that seems to be worrying you is that the slot must not be so wide that the light ray passing through the film would not disperse and take in two of those cells? A. That is correct.

XQ741. Now, it would have to be a pretty wide slot to do that, would it not? A. Well, with these lines disposed at 88 or more, say 100 per inch, a relatively small spread—for instance, if the line, instead of being .01 of an inch wide was .02 of an inch wide, it would naturally spread over two of these selenium cell operating devices.

XQ742. How is Greensfelder going to operate 88 selenium cells or 88 subdivisions of a selenium cell through light passing through 88 lines on this film in a practical sense? A. Well, each selenium cell receives the light passing through one of the lines or slots which he is forming on his positive film.

XQ743. Well, perhaps you can tell us how he is going to arrange those selenium cells so that is possible. A. Well, he shows or suggests a structure in which the selenium cells are arranged 860 side by side.

XQ744. Yes, he has a diagrammatic showing here, but that does not tell us how you are going to do it as a practical matter. Have you any suggestion as to how that thing could be done as a practical matter? A. Well, it seems to me it is perfectly obvious that if you have on your film, on the positive film, we will say, one line for each key of the piano, that space is set aside for each key. Now, if that becomes transparent, the light passes through that and falls onto a corresponding selenium cell. When that is energized, it then 861 operates the appropriate or corresponding key on the piano.

XQ745. What I am trying to get at is how you can physically arrange these selenium cells so that you can take light rays passing through a space that is occupied by these lines and so divert those respective and separate—those respective light rays, that they can operate separately and independently in its selenium cell, select them? A. Of course, the selenium cells are not arranged directly in front of the film, that is, close to the film. They are arranged at some

distance from it and an image of this film is projected onto the selenium cell assembly.

XQ746. He proposes to select certain of the rays which are projected from his motion picture projector through his motion picture to operate the selenium cell? A. Yes.

XQ747. Or certain of the rays that are projected through these slots—which? A. Well, the film is run through a projecting machine, that is, when you are reproducing the record, the sound
863 marks and the picture are on the same positive film. They are being carried through a projector, and that same projector projects light through these various translucent areas onto the selenium cell assembly which is at some distance and in the proper position relative to the projector.

XQ748. And he depends then upon the light rays which are coming from his motion picture projection machine, but such of those light rays as are passing through these slots or so-called sound marks, transparent sound marks, on that film? A. Yes.

864 XQ749. And then that same beam of light, although the part that comes through the sound marks is projected toward the screen and has got to set up his selenium cells, 88 of them somewhere in the theatre, in that beam of light between the machine and the screen on the stage in order to intercept those lines of light to operate these mechanisms here, to operate his instruments? A. Yes, that is correct.

XQ750. Now, Mr. Jones, reverting to the undue spread of images, tell us what you refer to by development to a high density. What is the extent, relative spread? You have got a line now on the film, an opening, a transparent opening. That

is what you want, a transparent window for the light to go through, and the only necessity in Greensfelder's operation is to get enough light through there to operate the cells, and, as you say, to be able to get 88 spaces.

Now, you say that if you have too highly developed a film, you get a spread, and hence a broadening of these lines, and I ask you how high have you got to develop the film, how much of a forced development have you got to get in order to broaden these lines by that forced development 866
so that you are going to get into any trouble? A. The forced development that I spoke of was in connection with developing the negative record—

XQ751. I so understood. A. —and the amount of spread that you get in any case will depend upon the characteristic of the photographic material. It will depend upon that characteristic of the material which we know and refer to as the astrogamma, which is the growth of an image laterally—

XQ752. I do not mean to interrupt you, but I 867
think you are going into unnecessary detail in your answer. You have said, I believe, that Greensfelder used ordinary negative stock? A. Correct.

XQ753. Let us try not to get away into too technical things. With this ordinary negative stock, what is the relative increase in width of these lines he proposes to use, or what would be the relative increase of width resulting from this so-called forced development? A. I think it would be very easy, in the case of forced development, to double the width of the lines.

XQ754. Well, there is ample room on the film

for doubling the width of the lines, with 88 marks as a maximum, isn't there? A. It depends entirely upon the mechanical and physical dimensions of your arrangement.

XQ755. Take a line that is sufficient to get light through and no more— A. Well, if the recording arrangement were set up, let us say, to record 88 parallel marks on the film, and the free space available is only one inch, the space available for that would be approximately 1/100 of an inch,
869 or slightly more. Now, with that—

XQ756. 20 per cent. more, wouldn't it? A. Well, about 12 per cent. more, we will say.

XQ757. I thought you said 80. A. Certainly, in making such a set-up as this, one would wish to use as wide a line as possible, so that through the corresponding transparent space—

XQ758. I beg your pardon, but I asked you to assume he had a line only wide enough to get light through to the selenium cell. I do not think there is any need to get it wider than that? A. That line may be less than 1/100 of an inch, and
870 you will have to double that line—

XQ759. Mr. Jones, certainly selenium sells respond to light through lines less than that width, don't they? A. It depends entirely upon the intensity of the light which would be concentrated thereon.

XQ760. Don't they respond to the fine lines in the ordinary standard sound records of today? A. That is perfectly true.

XQ761. How many have you got to an inch? A. About 100.

XQ762. What? A. Well, that is a sound record?

XQ763. Yes. A. It depends upon the frequency.

XQ764. Take an average, do not let us quibble about it. A. Taking an average of frequency, about—

XQ765. Roughly speaking, I do not want to tie you down. We have got plently of latitude. A. Perhaps 1,000 per inch.

XQ766. That is good enough for me, 1,000 per inch, 1,000 lines to the inch, lines that wide, openings that wide for the light, will cause satisfactory response on the selenium cell? A. It depends entirely upon the amount, the intensity, 872
the light flux, which is concentrated upon those lines.

XQ767. Mr. Jones, do not let us get into those high details, let us get down to bed rock in a very simple way. It is a fact those selenium cells do respond to light passing through on what I term a standard sound record? A. Correct, yes, that is correct.

XQ768. And you have admitted to an average of 1,000 to an inch; therefore, it seems to me that you must admit that wou will get enough light through an opening narrow enough to occupy 873
1/1000 of an inch; is that so? A. I think it can be done.

XQ769. Isn't it so in practice? A. Again in the actual carrying out of this idea—

XQ771. I am talking about the standard practice today, 1/1000 of an inch is enough to get light through, to operate a selenium cell, isn't it? A. Yes.

XQ772. All right. Then, is there any necessity for having more than two thousandths of an inch, let us say, I will let you double that, 2/1000 of an inch, to operate a selenium cell by Greensfelder? A. Again I do not feel that I can answer

that question unqualifiedly. It depends upon the structure—It would depend upon the structure which is set up for the operation.

XQ774. Let us go back to the Greensfelder. You have got a ratio now of 88 to 1000, 88 to 1000. Now, do you still maintain that with lines of that additional width in Greensfelder over the common practice in sound track records, that your so-called forced development would create any distortion in Greensfelder's operation? A. Yes,
875 I do feel it is entirely possible that forced development will create sufficient distortion of a record of that type to be troublesome in practice.

XQ775. As a matter of fact, Mr. Jones, as a matter of practice, if you have 88 lines to the inch, as in Greensfelder's sound marked proposition here, and a picture record, you would expect that those two records could be developed at the same time on the same bath without difficulty, wouldn't you? Having the pictures developed appropriately? You would expect that in that case the sound records would not be hurt? A. If the pictures were all correctly exposed, yes.

XQ776. Well, exposed within the region of practice? A. Within the region of practice which was customary at the time of this patent, it was necessary to subject different takes to considerable variation developments.

XQ777. Well, now will you give us in figures, what the broadening would be for your forced development? A. I said a moment ago that it would be very easy to broaden the line, to double its true width, by that I mean the true width of the exposed area, by forced development.

XQ778. And that would be the maximum broadening effect? A. No, I do not think that would be the maximum, no.

XQ779. That would be about what you would expect in practice you would have to do or might be done? A. Yes, I think that is a fair approximation of what might happen.

XQ780. That would give you twice 88, would it not, as against 1000 which practice shows is entirely satisfactory; is that right? A. Yes.

XQ781. Now, with regards Kindermann British patent, you testified in answer to Q189, "this patent discloses the simultaneous recording of pictures and sound on a photographic material," and then you went on and said, "to the edge of 878
which there was attached a thin metal strip." You did not mean that the patent disclosed the simultaneous recording of the picture and sound on the photographic film, did you? A. No, on the combined structure.

XQ782. You were asked at Q190, "Does Kindermann combine the sound record and picture record into separate sound and picture records? A. Yes, as I have stated, after exposure, the part of the record carrying the sound—the part of the film carrying the sound was separated from that carrying pictures." 879

What do you mean by using the words "after exposure" with respect to Kindermann, and the term "carrying the sound"? A. I mean after the exposure of the film to the picture record and the recording of the sound on the metallic strip which was attached to the picture record during the exposing operation.

XQ783. You said "Yes, as I have stated, after exposure, the part of the record carrying the sound," and so forth. What you meant was after exposure of the picture record? A. After exposure of the picture record, the part of the structure carrying the sound is separated.

880 *Lloyd A. Jones—For Defendant—Cross.*

XQ784. It is a fact, is it not, that there is no exposure in this patent of the sound record at all? A. That is true; the sound is recorded in a phonographic manner.

XQ785. And the next question you were asked with regard to the Kindermann patent: "Then are the two negatives developed separately?" and you answered, "They were developed separately." You did not mean to suggest by that answer that there was any photographic development of
881 the sound record, did you? A. No, that is a photo-mechanical treatment.

XQ786. What is the photo part of the treatment that you say is photo-mechanical? A. Well, it is a treatment, an etching treatment that is used, a similar treatment which is used—I think that should not be called a photo-mechanical treatment, it should be an etching treatment, that is the correct terminology there.

XQ787. Then there is nothing "photo" about Kindermann? A. There is nothing photographic about his sound record, his phonographic record.

882 XQ788. Is this a fair statement as to what Kindermann discloses: He records by having a flexible zinc strip coated with wax, and the stylus operating thereon forms a sound record such as a gramophone record, this being done while the pictures are being taken. To reproduce from this, a flexible celluloid strip in which this sound groove is formed by etching, as you say, is made, and then this strip is fastened to the picture film and the sound is reproduced again by a stylus. Is that a fair statement of Kindermann's patent? A. Yes.

XQ789. It is nothing at all except the old gramophone stylus sinuous path upon one strip which

is secured to the picture film? A. That is correct.

XQ790. With regard to the Rosenberg patent, at Q200 Mr. Ashton has asked us to change your answer in that, so I will read it as changed. "Q200. Suppose they were recorded on separate films. What does he do with those two films after he has developed them?" Then the answer as corrected: "The patent provides for the printing of the records onto separate films." The answer originally read that the patent provided for the 884
printing of the records on the same or onto separate films. Now the corrected answer is the one that you accept? A. That is right; it was my mistake.

XQ791. Now, to summarize this Rosenberg patent, as I understand it, he shows a picture record and a sound record, and he proposes taking them separately, keeping them separate, or he proposes as the other method taking them all on one film together and keeping them on one film, is that all? A. That is correct.

XQ792. Nothing else in that patent? A. There 885
are many other things but—

XQ793. I mean in regard to the process. A. As far as the photographic process is concerned.

XQ794. Mr. Jones, with respect to the French patent to Vogt-Massolle, 532,750, of course you understand that as an expert you are concerned with the disclosures here, not with what this patent may claim?

XQ795. The matter of the effect of this patent, for the purpose for which it is up, is a legal point for the Court. I am directing my question to you as to the disclosure in this patent, and not to any question as to what the patent claims

to patent as an invention or seeks to patent as an invention.

XQ796. You understand the difference, do you not? A. Yes.

XQ797. Now, is it your contention that this French patent discloses a process for producing the sound and picture records on a positive film wherein the sound and picture records are photographed simultaneously? A. Yes, it seems to me the disclosure so reads. It certainly is directed
887 to the making of sound films, and in the last paragraph, on page 2, it says definitely that during the motion picture recording of the original plastic scene one can couple in a positive manner to the motion picture film driving mechanism the film winding drum of a separate and distinct accoustograph which indicates they are recording pictures and sound simultaneously.

XQ798. And on separate films; you so testified yesterday, I think? A. Yes.

XQ799. Does the patent also disclose the idea of separately developing those two negatives, the
888 sound and picture negatives? A. Yes, I think it does.

XQ800. You haven't much doubt about it, have you? A. No, I have no doubt about it, because it refers, it goes on to refer to the case where sound is recorded at a subsequent time, and then refers, speaking of these two methods—

XQ801. I think you had better stick to the method where they are simultaneously taken on separate films. In that case does it disclose the separate development? A. Well, I do not see that we can divorce the two because it states very distinctly in the third paragraph on page 3, in referring to both methods of recording, it says

in both cases the subsequent processes, I am not quoting, are the same for the two. Now certainly in one case the development must be separate.

XQ802. In the case where they were taken at different times? A. Yes; they must have been separated because the sound is recorded while the original thing is being projected. It must have been developed and printed so it could be projected. And if the subsequent treatment is the same in the two cases, it implies separate development in both cases. 890

XQ803. Will you read the full statement there about separate treatment? A. The patent states in the third paragraph, on page 3, that: "The subsequent treatment of the picture films, after exposure, is, in both cases, the same as far as the printing process, reproduction process, etc., are concerned."

XQ804. Then you desire to answer my other question "Yes", that it does disclose a separate development? A. Yes.

XQ805. With the separate negative. Then does the patent further disclose that having taken 891 the sound record and the picture record simultaneously on separate films, and then separately developing them, does it disclose the further step of printing them on a common positive film so that they are longitudinally arranged side by side on one face of the film? A. The patent does not go into that detail, but it states very definitely that the two records can be copied on the very same film band.

XQ806. You assume that when they are copied on the very same film band where they have been taken on separate negatives and separately developed and printed on the same film band, they

would naturally be printed in that position, that is, longitudinally side by side on the same face of the same film band? A. Yes.

XQ807. Mr. Jones, you recently had an interview with Mr. Bullis, the patentee of the patent we have been talking about here? A. I have seen Mr. Bullis.

XQ808. Why, didn't you and an R. C. A. representative and a representative of Western Electric have an interview with him not long ago?
893 A. Yes.

XQ809. You talked to him about this patent? A. Yes.

XQ810. Did you get any comfort out of this interview with regard to Bullis' disclosures? A. I personally did not discuss the matter with Mr. Bullis but very little; I was only present at part—

XQ811. There was such an interview at which you were present?A. Yes, partially.

XQ812. Now, Mr. Jones, in regard to these pictures that you have put in evidence here, De-
894 fendant's Exhibit E, which were made somehow by somebody up at your plant, according to your testimony, as I understand your testimony, after they were made, after you have assumed they were made, one was made with what was supposed to be the defendant's positive developer and the other with what was supposed to be the defendant's negative developer, and in developing each different times of development were given, is that correct? A. That is correct; the exposures were developed to the same contrast.

XQ813. Now, was it your idea in putting these pictures in, developed as you have testified, to rebut or contradict Mr. Hoffmann's testimony

about his experiments? A. I had no knowledge of Mr. Hoffmann's testimony at the time we made these pictures. These pictures were made specifically to show that the two developers give the same character of development.

XQ814. And you have defined character of development as development carried out by any developer where the activating ingredients or active ingredients are the same, even if different in quantity? A. That is not the whole definition of the same character of development. I have 896 defined the same character of development as this development, treatments which gives identical results with respect to the grain size, grain structure, color of the image and shape of the characteristic curve.

XQ815. Now, you have the negative present from which these two pictures of Exhibit E were made? The negatives seem to have a decided bluish or purplish cast to me as a layman. Will you tell me why that is (handing to witness)? A. I fail to see the bluishness. They seem of normal color.

XQ816. The negatives look to you to be en- 897 tirely normal? I am not saying they are not. I am just asking you for information. A. Yes, they seem to me to be of normal color so far as I can see under these conditions.

XQ817. Is there any reason, Mr. Jones, why the areas of these negatives of Exhibit E, where there is no film, such as where the sprocket holes are, or on no emulsion such as where the sprocket holes are, should have any dark or different tone from these strips of film, negative film which you used in connection with getting data for your Exhibit E? A. Those negatives may have been

made, as I think they are, on the emulsion which is coated on what we call a gray back, which is merely one of our methods of making this material. The film base itself has a color, but the emulsion is the same in the two cases.

XQ818. Does that gray film back have anything to do with making these two pictures look as dark as they do? A. Yes, of course it would.

XQ819. It results in having the pictures of Exhibit E unduly dark, does it not? A. Well, it
899 adds a perfectly uniform density—

XQ820. No, just answer my question. It does result in making these pictures quite dark? A. Yes—no, it does not have anything to do with making those pictures look dark.

XQ821. What pictures are you talking about? A. The negatives, themselves.

XQ822. These pictures are printed from those negatives? A. Quite.

XQ823. And they are dark, are they not? A. Well, they are relatively dark prints, but—

XQ824. The character of these prints, being as
900 dark as they are, both in the black and white, tends to minimize contrast, does it not? A. No, it does not.

XQ825. Does it minimize your power to see the contrast with your eye? A. The particular composition is responsible for this density distribution—

XQ826. Why was that composition chosen for this test? A. It was chosen because we considered the negative from which it was made to be a good quality negative to show a good photographic quality.

XQ827. Certainly, you have a lot of nice negatives, of good photographic quality, in the East-

man plant, that have not got that original difficulty in the subject, have you not? A. Possibly. I did not choose this particular negative myself.

Mr. Neave: What difficulty are your referring to?

Mr. Ward: I refer to the difficulty, Mr. Neave, in the contrast of the pictures.

XQ828. Now, if the subject had been a lighter one, do you not think that we could get a better idea of the true contrast or relative contrasts? 902
A. Why, I don't know. Possibly, as far as I am concerned, these are sufficiently of a satisfactory quality to show me that the characteristics of those pictures—

Mr. Ward: I move to strike that out. I asked nothing about characteristics.

The Court: All right, strike it out. Go ahead with your questions.

XQ829. As a matter of fact, taking these pictures as they are, do you not detect a difference 903
in contrast between the two? A. There may be a very slight difference of contrast. They, to me, however, look quite closely matched.

Mr. Ward: That is all, except that I would like to have the negatives in evidence.

Mr. Neave: I offer in evidence the negatives, from which Defendant's Exhibit E were taken.

Received in evidence and marked Defendant's Exhibit K.)

904 *Lloyd A. Jones—For Defendant—Re-direct.*

Re-direct examination by Mr. Neaves:

RDQ830. Still referring to this photograph, Defendant's Exhibit E, that is a print, as I understand it, enlarged print from the negative that has just been put in evidence? A. Correct.

RDQ831. And depending upon how you print that, you will get a light print or a dark print, won't you? A. Yes, that is true.

RDQ832. That is, the lightness or the darkness of the print, does not show the lightness or
905 the darkness in the negative? Not at all.

RDQ833. And is this photograph, Defendant's Exhibit E, the prints, are they fair, good prints, from those negatives? A. They are fair prints. I think they are, perhaps, on the dark side.

RDQ834. You could have printed them lighter, and if anyone wants to print them lighter, they can print them lighter from these negatives here? A. Yes, that is perfectly true.

RDQ835. In the early part of Mr. Ward's cross examination, he was asking you about what there was in the patent in suit that showed that
906 the films there depicted were or were not of standard width, and I don't remember that you referred to any particular part of the specification. At line 57 of the specification, on page 1, I find this:

> "If for the record two separate films with standard perforations are used two negatives are produced as shown in Fig. 1."

What do you understand that means as to standard width of film? A. I understand that to refer to the standard width of perforation

of film which was in use commercially at that time for silent pictures, that is, the normal 35 millimeter film.

RDQ836. So that irrespective of whether the drawings are schematic or whether they are drawn to scale, do I understand that that means that the two films shown in Fig. 1 are each of them of standard width? A. Yes, it certainly does.

RDQ837. And then when they are combined in Fig. 2, they are not of standard width, is that 908
it? A. No, they could not be.

RDQ838. It appears from your testimony that the character of development of the defendant's sound and picture negatives is the same, but that different times of development are used. Will you state again why the different times of development are used as a matter of practice? A. The different times of development are used so that the desired contrast will be obtained for the two cases. The time is made short in the case of the sound negative so that the film may be run through the machine at a higher velocity. 909
The concentration of the developer is adjusted so that that time can be made short and thus give a larger output of work.

RDQ839. As a matter of practice, what developer is used for developing the positive print or the positive film?

Mr. Ward: Do you mean by the defendant?

Mr. Neave: By the defendant or by others that you know of.

Mr. Ward: He said he did not know much about defendant's.

910 *Lloyd A. Jones—For Defendant—Re-direct.*

RDQ. (Continued.) I don't want you to give the ingredients. Is it the same developer that you used to develop the positive sound negative, positive emulsion of the sound negative? A. No, it is a different developer, it is a developer of the elon hydroquinone type, and one that is adapted to give the desired contrast in the combined sound and picture print.

RDQ840. You have said that you have specialized in the past in the principles of tone
911 reproduction. Were those principles well-known before 1921? A. Yes, very well-known.

RDQ841. Do they apply equally to picture and sound records? A. Yes, they do.

RDQ842. State whether or not those known principles included the relation of density and exposure, what has been referred to as gamma, photographing on the toe of the curve and on the straight line portion. A. Yes, all of those relationships were known. As a matter of fact, the development of the tone reproduction theory dates from the work of Herbert Riffield about
912 1890, and they and Lord Rayleigh and other workers, notably Renwick and Porter and Slade, in England, developed the theory of tone reproduction very completely, which shows the relation between the density characteristics, contrast characteristics of the negative and positive, that are required to give a precise reproduction of the brightness in the object. The question of using the under-exposure portion of the characteristic curve of the negative and positive materials was considered at great length by Renwick in a series of papers, and he worked that theory out very completely.

RDQ843. Will you state again why it is that

you are testifying here, that is, what interest has Eastman in any of these things? A. Why, I am testifying here, as I stated before, because I was so directed by my superior, and the Kodak Company, of course, has had very friendly relations with the Bell Telephone Laboratories, the Western Electric people. As a matter of fact, they endeavor always to give any assistance they can to anyone using their materials—

RDQ844. That is, Eastman does? A. Yes. I am afraid I cannot speak from the standpoint of 914
the management of the company as to just why—

RDQ845. Do you know whether the Eastman Company gave any service in New York to Mr. Hoffman, who has testified here?

Mr. Ward: I object to that, your Honor, for the same reason that Mr. Neave objected to mine. He cannot tell what the company did unless he had p e r s o n a l knowledge.

RDQ846. Do you know of your own knowledge 915
whether they gave personal assistance to Mr. Hoffman? A. Yes, I do.

RDQ847. And do you know of your own knowledge whether they give assistance to others with reference to emulsions and photographic films and how to use them? A. Yes, I do.

Mr. Neave: I offer in evidence a photostatic copy of the German patent 368,383, to Vogt, Massolle and Engl.

(Marked Defendant's Exhibit L in evidence.)

Mr. Neave: I offer in evidence certified

copy aand translation of the history of the application for the German patent which resulted in the patent last mentioned.

(Marked Defendant's Exhibit M in evidence.)

Mr. Neave: I offer in evidence the following papers as one document, these being certified and sealed together by the British Patent Office. They relate to the British patent 178,442, corresponding to the patent here in suit, the papers being:

917 First, the British application as open to public inspection in the British Patent Office on April 15, 1922, four days after it was filed; second, the corresponding German application as filed in Germany, and a translation; third, the patent as issued; fourth, an assignment from the inventors, dated August 16, 1924, to Tri-Ergon, A. G., the Swiss Company.

Mr. Ward: I object to the introduction of the British patent and File Wrapper as

918 irrelevant and immaterial. It has not anything to do with this suit. What happened in the British Patent Office is wholly immaterial and irrelevant. There is no priority based on it. It is not prior art and it has got nothing to do with this case. Mr. Neave simply wants to show some File Wrapper argument of some British attorney in the prosecution of that case.

Mr. Neave: It is not argument. It is what was done.

Mr. Ward: It has nothing to do with this case.

 919

The Court: I do not believe that it would have the same weight as the File Wrapper has here, but nevertheless I will take it, and you can move to strike it out.

Mr. Neave: It shows what was done, and not the arguments, and we shall call your attention to some decisions saying that it is pertinent to show what the inventors did.

The Court: I will take it.

(Marked Defendant's Exhibit N in evidence.) 920

EDWARD C. WENTE, called as a witness on behalf of the defendant, having been duly sworn, testified as follows:

Direct Examination by Mr. Neave:

I live in the Borough of Manhattan and am an accoustical research engineer for the Bell 921
Laboratories which were established in 1925, connected with the American Telephone & Telegraph and Western Electric. I have been in research work for the Bell system for 16 years.

I was a student at the University of Michigan, from which I graduated with the A. B. degree in 1911.

In 1911 and 1912 I was at Lake Forest College, instructor in physics and mathematics, and from 1912 to 1914, I was a student at the Electrical Engineering Department of the Massachusetts Institute of Technology, from where I was grad-

922 *Edward C. Wente—For Defendant—Direct.*

nated in 1914 with the degree of Bachelor of Science in electrical engineering.

From 1916 to 1918, I was a student in physics and mathematics at Yale University, and was graduated with the degree of Doctor of Philosophy in 1918.

In that interval of two years between the time when I went to Massachusetts Institute of Technology and the time I went to Yale, I was employed in the Research Department of the West-
923 ern Electric Company. At that time I was engaged in the study and development of sound-measuring devices and other electrical accoustical instruments such as the condenser microphone and the thermaphone. A thermaphone is a device which is used—it is a type of telephone receiver, but it is used principally for the calibration or the accurate determination of the performance of microphones. When I left Yale in 1918, I then returned to the Western Electric Company. And I remained with the Research Department of that company until the Bell Lab-
924 oratories were established, and ever since then I have been with the Research Department of the Bell Laboratories. The Telephone Company has been dealing with problems relating to sound for a great many years; I should say from almost the very beginning.

Tracing the various aspects of the development work of the Telephone Company which resulted in the introduction of the Western Electric talking movie picture sound-recording and reproducing systems—The problems involved in the development of the recording and reproducing system of talking pictures are in many re-

925 spects identical with those that are met with in the development of a high quality long distance telephone system. In either case, we require a microphone, which is a device for translating sound into a corresponding electric current, an amplifier or device, which can transform the relatively weak currents, such as are delivered by a microphone, into corresponding currents of very high strength, and thirdly, some type of device, such as a telephone receiver, is required for translating the electrical current into cor- 926 responding sound.

In the talking picture, it is absolutely important that each one of those devices shall perform its function with practically no distortion. By "no distortion", I might say, of a translating device, we mean that if we have at the same time impressed on the input of the device a series of harmonic oscillations, then there shall be generated on the output a corresponding series of harmonic oscillations, and with no additional ones, and that the relative amplitude of these harmonic oscillations shall be the same on 927 the input as on the output.

Now, the telephone company felt the need, at quite an early date, for some kind of amplifier, for in this country, in contrast with Europe, important cities are separated many thousands of miles, and an amplifier is needed in order to connect these cities. So a number of amplifiers were developed for this purpose.

In 1912, they began the study of the audion, in order to develop it into an amplifier for this telephone service. By January, 1915, these amplifiers, together with associated circuits, had

been developed to the point whereby their use in trans-continental telephone service, that is, between New York and San Francisco, was established on a commercial basis.

These amplifiers have been the subject of practically continuous study of the telephone engineers since that date, and, of course, have found very many applications.

For instance, in the public address system which was brought out by the Western Electric
929 Company to enable the speaker to address a much larger audience than he would be able to do with the unaided voice, and such amplifiers were used in the public address system in 1921, at the inauguration of President Harding, when a gathering of some 125,000 people were able to listen to the inaugural ceremonies around the Capitol steps. And these amplifiers, this type of amplifier, so-called vacuum tube amplifiers, are used today, as far as I know, exclusively in in the recording and the reproducing of sound for talking pictures in theatres.

930 The telephone company engineers have also been interested for a long time in the development and improvement of microphones from the standpoint of efficiency, quality and reliability, and as early as 1912 or 1913, an improved form of microphone was used with a Duddell oscillograph in connection for making sound records.

With the advent of amplifiers, the development of high quality microphones received a fresh impetus because it now was no longer necessary that a microphone should have high efficiency, but efficiency could be sacrificed to the interest of good quality. In 1914, when I

first came with the Western Electric Company in their research department, I was soon thereafter given the problem, and started work on the development of a microphone of the very highest quality, because the company was at that time also becoming interested in the transmission of music, where a much wider frequency range has to be transmitted, and also a much greater loudness range than for speech.

But there was one difficulty in our efforts to build such a microphone, to develop such a 932
microphone: There was at that time no means available for determining the performance of such microphones, and it was for that reason that I, in colloboration with Dr. Arnold and Dr. Crandall, developed this thermaphone, which I have already mentioned the function.

Then with this thermaphone available, I devised and developed the condenser microphone. 1916 is when we had completed the construction of a model which had practically uniform response over the whole accoustic range.

In the development of these condenser micro- 933
phones, the work or further development work was interrupted by the World War, but in 1919, I again came back to the Western Electric Company—this was after the war, a year after I had gotten back, and started further work on these microphones, and by 1923, I had increased their efficiency by a factor of about 100 times. This type of microphone is used today in practically, or until very recently, at any rate, in practically all the sound recording work, both for phonographs and for talking pictures, it was used practically exclusively.

934 *Edward C. Wente—For Defendant—Direct.*

I have already mentioned that it was in 1913, the engineers at the laboratories had made sound records by means of a microphone and an oscillograph. These records are of the so-called variable width or variable area type, records that you obtained with the Duddell oscillograph.

But in 1916, records were also made by the variable density method, but the quality was not sufficiently good, so that we felt that it had no particular commercial value at that time,
935 and we went into further development work on another apparatus.

But in 1920, I again took up the study of recording the sound on film by the variable density method. I, at that time, felt it was very important that any device which would be used for recording sound in this way should expose the film correctly, that is, should give it the correct exposure. After considering various devices which had previously been proposed, I thought that the method that was being used at that time for the transmission of speech, by a light beam
936 by Professor Rankine in England, appeared to be the most suitable device for obtaining the correct exposure.

I therefore constructed an instrument of this sort and made sound records on motion picture film and reproduced them. The quality compared very favorably with what we were getting on commercial phonographs, but still it was not good enough to satisfy us, and after extensive test we came to the conclusion that the exposure that we were able to get with this system was not sufficient to give us the correct exposure.

It was then that I devised the so-called light

valve, which we found gave us plenty of exposure, so that even with the higher speeds that are being used now, the exposure was sufficient.

And this type of light valve for recording has been used in the Western Electric sound recording system, as it was adopted by the majority of the producers.

I have described the course of my work up to and including 1922 and early 1923.

Q19. And you have said that then you had made your variable density sound and picture 938
films? A. That is right, in 1922.

Q20. What relation did your variable density sound record have to the picture on the film? Did it run alongside on the standard width film, or was it a separate film or what? A. Separate film, a separate film for the sound and a separate film for the pictures.

Q22. In the negative and also in the reproducing? A. Also in the reproducing. In the reproducing, we used the same machine that we had used for recording. We also used it for the reproducer.

939

There was another line of development that had been going on at the same time with reference to the recording of sound. At about the same time the development work was going on, in another section of the research department on the recording of sound on wax records. In 1915, we made reproducing devices, electrical reproducing devices to be used with phonograph records which gave very superior reproduction, but it was not until after the war that the work was carried on aggressively in the development of electric machines for recording sound on wax

records. At that time, a group of engineers under the immediate direction of Mr. Max Field made great improvements in the recording device to be used with the microphone and amplifier and this type of so-called orthophonic electrical method of recording was adopted by the Victor and the Columbia Phonograph companies, for the making electrically of wax records, and in October, 1922, a lecture was given by Mr. E. B. Craft, at New Haven, Connecticut,
941 in which he showed a picture with accompanying sound which was recorded by this means and reproduced. They improved the synchronizing devices, as well as the recording apparatus so that they could make much longer records on the same sized disc. By 1924, these engineers felt that the quality was sufficiently good, so that they could use this system for making talking pictures with commercial success, where previous attempts had failed, and in 1925, the system was shown to the Warner Brothers, and they became interested to take out a license, and
942 in 1926, brought out the talking pictures under the name of Vitaphone.

The first public exhibition of that was August 6, 1926. That was at the Warner Brothers Theatre in New York. Since that time the Western Electric sound recording equipment has been installed continuously.

Q26. Was that first public exhibition in 1926, a success? A. Yes, and soon thereafter a large number of theatres were equipped with equipment suitable for producing talking pictures by that method.

Q27. All of this involved, I assume, the use of

the loud speaker of your development? A. In the public address system, such as was used in 1921, in Washington, a loud speaker was used which was capable of delivering sound at quite a high level. That was the work of quite a long period of years by the engineers, and in 1926, they had a loud speaker of a similar type, but more efficient, with which to experiment in the Warner Brothers Theatre in the reproduction of music, but it was found that the fidelity and the loudness with which the low frequencies and 944
high frequency sounds could be reproduced was not sufficient to give the best results. So at that time, commercial development work was progressively carried out on a new type of loud speaker, which was then under study in the laboratory. This loud speaker had a practically uniform response from two octaves below the middle C of the piano to about one-half octave above the highest note of the piano and was from 50 to 100 times as efficient as the loud speakers previously available. And this type of loud speaker was used in the first presentation 945
of talking pictures by Warner Brothers, and has since been used almost exclusively in almost all equipment in all theatres. I got a patent on this.

Mr. Neave: The patent for that loud speaker development that Dr. Wente has referred to, was involved in the case of Western Electric Company vs. Kersten Radio Equipment, Inc., and Judge Raymond in 44 Fed. (2nd) 644, sustained the patent.

Q29. Now, I would be interested in knowing a little more definitely what the Western Elec-

tric Reproducing system is. Have you a diagram that shows it, does this diagram show it? A. Yes, sir. One is for the recording, and the other the reproducing.

Mr. Neave: I offer in evidence the recording diagram the witness has before him.

(Marked Defendant's Exhibit O in evidence.)

947 The Witness: This diagram shows the various parts of the apparatus of the Western Electric Sound Recording System, as it is used for the making of talking pictures in the typical sound picture studio. There are four rooms, four or five rooms indicated here; at the extreme left is the studio stage in which is located—

Mr. Ward: Your Honor, I object to this unless the defendant uses it.

Mr. Neave: They do use it.

The Court: Of course, the question here
948 is what the defendant uses, and if the defendant uses this system, why, all right.

Q32. Do you know whether the defendant uses this system? A. Yes, sir. At the extreme left is the studio stage in which is located, as I said, the scene which is to be photographed and recorded. Here are located the cameras and the microphones, generally one or more microphones are used. In this particular case, two are indicated which are of the condenser microphone type which I have discussed previously. And associated with these microphones, each micro-

phone, is an amplifier, which are enclosed in the case as shown, and the output of these amplifiers is connected to a panel on a table which is shown in the room designated as the monitor room. In this room, there is indicated here a mixer, and by means of this mixer, the person in the monitoring room can control the relative amount of current coming from the microphone amplifiers, on the way to the recorders.

The microphones in the studio stage are located in different parts of the scene, and by 950
means of this mixer, the amount of sound coming from different parts of the scene that is to be recorded can be controlled.

On this table is also located another control box, which is here indicated as the volume indicator. With that volume indicator, the attendant in the monitoring room can vary the level with which the sound is recorded.

In this room is also located the monitoring horn which is supplied from the recorder and reproduces the sound just as it is being recorded. The attendant in the monitoring room can look 951
through a window into the studio stage and by means of his control can so adjust the sound that is being recorded as to be most appropriate for the scene that is being photographed.

In the room to the right of the monitoring room is the amplifier room in which are located the main amplifiers which increase the currents by thousands of times as they come from the microphone and are being delivered to the recorders. Part of the output of the amplifiers is connected to the film records, designated here as "film recorder", in the extreme right of the

952 *Edward C. Wente—For Defendant—Direct.*

picture, in which the sound is recorded photographically, by the so-called sound on film method; and part of the output is also connected to the disc recorder. This disc recorder is a recorder of the type such as you have in the case of a phonograph, and makes a record on a soft wax roll, and is in such shape that it can be reproduced immediately after recording, which it is impossible to do with the photographically recorded records.

953 The purpose of this disc recorder is that it enables the director to listen to the sound that has been recorded immediately after the scene has been photographed.

Below the amplifier room is located the power room. In this power room is a motor which is driven by a vacuum type control device, so that it will always run at exactly constant speed, even if there are line variations, there may be variations either in frequencies or in voltage, but the motors will always run at the same

954 speed.

Mr. Ward: Your Honor, I object, the defendant does not do any of this stuff, and why put it on the record. What is the materiality of this? This all occurs after what is claimed in the patent is done.

The Court: I do not know.

Mr. Neave: That is what the defendant does.

Mr. Ward: That is all the tail end of it.

Mr. Neave: No, Mr. Ward's statement seems to have been, his inferences seem

to be that the defendant copied plaintiff's system, which it has not done at all. It has copied this system, it is using this system, which was developed prior to the time that the plaintiff had any appearance here at all. I am coming to that part in a minute, as soon as I show what it was they have.

The Court: He is pretty nearly through, but we must have some limit to this.

Q33. You have gotten now to the power room, 956
and then there seems to be a dotted line from the power room to the camera on the left, and to the film recorder on the right. What is that supposed to indicate? A. That connects the motor of the camera and the motor of the recorder to a distributor which is driven by this constant speed motor, and with this system, the motor there, as it is termed, is interlocked, that is each motor will make the same number of revolutions. And also by this system the motors are run at a uniform speed which is necessary 957
for the proper recording of sound.

Q34. So that your picture and your sound are taken synchronously; is that it? A. That is right.

Q35. Up in the upper right-hand corner of this drawing there is something marked "optical". Is that the light valve of which you have spoken in this case? A. That is the light valve, yes, sir.

Q36. What does the valve consist of? A. Well, the light is focussed on a slit aperture by the lens to the left. This slit aperture is

formed by two very light ribbons, which are separated by a space of something less than 2/1000 of an inch, and these ribbons being metallic ribbons are located in a magnetic field which is supplied by a magnet, by horseshoe type magnets here shown, and when current passes through these ribbons from the recording amplifier, they will oscillate, move towards and away from each other, and thus vary the opening of this slit aperture in accordance with
959 the current flowing through them, and this light from this slit is focussed by a second lens into a narrow transverse line of light onto the film, which, in the recording, of course, is moved at a uniform speed.

Q37. Now, we have gotten so far, you take two negatives simultaneously, one of the sound, and one of the picture; that is right, so far, is it? A. That is right.

Q38. It appears in the stipulation in this case, that the defendant then develops the negatives separately, and prints them onto the one posi-
960 tive film, both on the same side, arranged longitudinally. When did the Western Electric Company first develop that film record?

Mr. Ward: Wait a minute. You are not setting this up as an anticipation or prior use, I hope?

Mr. Neave: No, not at all.

Q39. This being the sound, variable density sound record on the same positive film as the picture record, when did the Western Electric Company first do that commercially and in the

laboratory first? A. Well, I can't say exactly when that was first done in the laboratories, because it was a question that was discussed from time to time as to—I think that was about 1925.

Q44. Did you do any work on recording sound on film before that? I understood you said you did. A. I started in 1920.

Q45. Had you previously had, at that time you did not have your sound and picture record on the same positive film? A. In reproduction, no.

Q47. It was about 1925 that you got them 962
both on the same positive film for the reproduction, is that it? A. That is I think about right.

Q48. Now, you described your light valve here, and also there has been some talk of the plaintiffs having used or proposed to use a glow tube. Are you familiar with the glow tube? A. Yes, I am.

Q49. Does it produce as great or greater amount of illumination than the light valve, and what is the relative capacity of each in that connection? A. The light valve produces on the order of ten times as much exposure of the 963
film.

Q50. It has appeared in some of the patents that are in evidence that it was thought that it might be disadvantageous to photograph the sound record and the picture record on separate negatives because they might get them out of synchronism; did you have any trouble in that connection? A. No.

Q51. How did you remedy the difficulty if there was any? A. Well, we used an electrical interlock.

Q52. That is the one you have spoken of? A.

964 *Edward C. Wente—For Defendant—Direct.*

That is the one we have spoken of; in the first picture that we took with recorded sound we used this interlock.

Q53. So that then you ran it synchronously in spite of them being on two films? A. That is right.

Q54. You stated that the first public showing of Western Electric talking motion pictures showing this was August 6, 1926. Had any motion picture producer except Vitaphone under-
965 taken regular commercial production of talking motion pictures prior to that time, as far as you know? A. No, none of the producers.

I said that the Vitaphone Company had a license from the Western Electric the Vitaphone granted a sub-license to the Fox Case Company in December, 1926, and this method of licensing was taken over thereafter by Electrical Research Products, Inc.

Other motion picture producers thereafter were licensed by that company, in May, 1928, the Famous-Players-Lasky Corporation, Metro-
966 Goldwyn-Mayer, United Artists, Universal and Firnatone got licenses.

Since then others have taken licenses here and in foreign countries.

In this country about 5,500 and abroad about 3,200 Western Electric reproducing equipments have been licensed by the Electrical Research Products, Inc. up to the present time. About fifty-five, foreign countries roughly.

I have described the work of the Western Electric Company that they did on this sound-on-film method and on photographing the sound and the pictures on separate negatives, and then

by 1925 joining them together on the same positive, and on the same side of the same positive.

Q66. Up to that time or thereafter did you have any knowledge of the work of Vogt and his associates or any of the Tri-Ergon companies anywhere in the world?

Mr. Ward: What time is that?
Mr. Neave: 1925 or 1926.

A. I had no knowledge. 968

Q67. Had you any knowledge of any of their patents or publications? A. Not at that time.

Q69. Now, it has appeared that in 1927 Mr. Engl came to this country with certain apparatus that he brought from abroad. Did you see any of the films that he had here then? A. I didn't see any of the films, no, sir.

Q70. I have here what purports to be a list of the first 25 theatres in which the Western Electric film equipment was installed. You are familiar with that list, aren't you? A. Yes. 969

Q71. When you speak of this film equipment, does that mean with the sound and picture record on the same positive film, sound and picture on the same positive film? A. I think that is theatres where the equipment is with the picture and sound on the same positive film.

This list that I have spoken of is the list of the first 25 theatres in which this Western Electric film equipment was installed.

Mr. Neave: I ask that this be copied in the record.

970 *Edward C. Wente—For Defendant—Direct.*

"First 25 Theatres in Which Film Equipment was installed.

	Location	*Theatre*	*Date Installed*
971	New York, N. Y.	Roxy	7/26/27—F.A.
	Phila., Pa.	Fox-Locust	8/31/27—F.A.
	Phila., Pa.	Fox-Phila.	8/31/27—F.A.
	Newark, N. Y.	Fox-Terminal	9/2/27—F.A.
	Toledo, O.	Temple	9/2/27—F.A.
	New York, N. Y.	Fox-Academy of Music	9/2/27—F.A.
	Springfield, Mass.	Fox-Springfield	9/3/27—F.
	Detroit, Mich.	Fox-Washington	9/10/27—F.D.
	Spokane, Wash.	Liberty	9/10/27—F.A.
	Jamaica, L. I.	Fox-Jamaica	9/10/27—F.A.
	New York, N. Y.	Fox-Audubon	9/10/27—F.A.
	New York, N. Y.	Fox-Crotona	9/10/27—F.A.
	New York, N. Y.	Fox-Star	9/10/27—F.A.
	Chicago, Ill.	Fox-Monroe	9/10/27—F.D.
	New York, N. Y.	Fox-Times Sq.	9/15/27—F.
	Washington, D. C.	Fox-Washington	9/17/27—F.D.
	New York, N. Y.	Fox-Jap. Garden	9/17/27—F.A.
972	New York, N. Y.	Fox-Nemo	9/17/27—F.A.
	Louisville, Ky.	Strand	9/25/27—F.A.
	Kansas City, Mo.	Globe	9/25/27—F.A.
	Terre Haute, Ind.	Grand	9/25/27—F.A.
	B'klyn, N. Y.	Fox-Savoy	10/7/27—F.A.
	B'klyn, N. Y.	Fox-Folly	10/10/27—F.A.
	B'klyn, N. Y.	Fox-Ridgewood	10/11/27—F.A.
	Elizabeth, N. J.	Fox-Liberty	10/14/27—F.A.

F.A.—Attachment to existing Disc Installation.
F.—Film Installation only.

F.D.—Film and Disc completed on date indicated.

(Note: Dates indicate completion only, and not dates opened to public.)"

973

Mr. Ward: I would like to have the witness testify a little more definitely whether in these 25 installations they did have this method of film. Mr. Neave asked him about whether he though they did. I would like to know that definitely.

Mr. Neave: Let me get something more in that the Judge hasn't seen yet in this list.

The Court: Do you want to get that first that Mr. Ward mentioned?

Mr. Neave: It is on the same line.

974

The Witness: This list indicates that in many instances this film equipment was added to a disc installation.

Q75. That is, the reproducing machinery was such that they could use either the disc or the film to get the sound— A. That is right.

Q77. Now, confining your attention only to the film, in these installations did they have or did they not have the film in which the sound record was on the same film as the picture record? A. The sound record was on the same film as the picture record.

975

Mr. Neave: I thought that this note about this disc might be confusing.

Q78. Are you familiar with the Fox Company's use of this Western Electric apparatus in the early days about 1926, which was earlier than this? A. Yes, in the early days.

Q79. What were they using of the Western Electric Company's in recording in June, 1926? A. They were using Western Electric microphones and amplifiers.

976 *Edward C. Wente—For Defendant—Direct.*

Q80. Reference has been made here to Fox Case reproduction in the Harris Theatre in New York in January, 1927, as being done by the Fox Case Company, as I understand it. What Western Electric apparatus was used there? A. In the recording, the Western Electric microphones and amplifiers were used; in the reproducing Western Electric amplifiers.

Q91. Then also some reference was made to a reproduction at the Times Square Theatre in September, 1927. What was it that was used
977 there? A. Western Electric equipment was used for the loud speakers, and microphones and amplifiers for the recording. This Times Square reproduction in 1927 was really the first all-sound production by the Fox system. The other presentations were all short subjects which were accompanied,—were given at the same time as a silent picture was, in the same show as a silent picture was presented.

Q82. In this September, 1927, production at the Times Square Theatre what was that sound, what was it on, was it on the film? A. That was
978 on the film. On the same film as the picture. It was a variable density record.

Q85. The same kind of thing that the defendant is using, according to the testimony here, the same film arrangement? A. The same arrangement of picture and sound.

Mr. Neave: Here is a diagram of the Western Electric reproducing system, which I will offer in evidence without any explanation, as I think it will not be difficult to understand.

(Marked Defendant's Exhibit P in evidence.)

(Witness temporarily excused.)

Whitford Drake—For Defendant—Direct. 979

WHITFORD DRAKE, called as a witness in behalf of the defendant, being first duly sworn, testified as follows:

Direct Examination by Mr. Neave:

My official residence, is Beverly Hills, California.

I live in the Essex House, Manhattan.

I am connected with Electrical Research Products as Vice-President. I have general supervision of the commercial side.

980

In 1927, I was with the Electrical Research Products. Either the latter part of 1926 or the first part of 1927, I met Mr. Engl who came over here from abroad along in 1926 or 1927, at that time. I know Mr. Joy of the Fox interests.

Q10. Mr. Joy has testified here that during that period, or some part of that period, there was some sort of a committee on which sat, if I may use that expression, some members of the Western Electric interests and some connected with the Fox interests, and he said that 981 you and Mr. Crandall were of that committee. Is Mr. Crandall alive now? A. No, Crandall is dead.

Q11. Now, it is true, isn't it, that you during that period did have some conversation with people of the Fox interests? A. I was in very close contact with the Fox interests at that time.

Q12. Do you know how those conversations came about, that is, did the Fox interests approach the Western Electric interests or did the Western Electric interests approach the

982 *Whitford Drake—For Defendant—Direct.*

Fox interests in the first instance? A. In the latter part of December, the Fox-Case Company was a licensee of the Vitaphone Company, sub-licensee, had a sub-license under the Vitaphone license from us, but our engineering and commercial relations were direct with the Fox-Case organization. And through that we were in contact with their experiments on recording and reproducing and their development work.

About that time, the latter part of December,
983 the Fox interests advised us that they were bringing over from Germany some apparatus which they thought might be of interest, and on which they had an option in this country for the patent rights, and asked us to go over this apparatus with them, with a view to asking us, or with a view to our taking a participation in any rights, and paying part of the cost of any rights which might be obtained.

There was a demonstration given—reverting again to the committee question, there was nothing in the formal sense of a committee ap-
984 pointed. We were asked to dine with the Fox Company and meet with them, and meet Dr. Engl and discuss the situation. I represented our company on the commercial side. I took along Dr. Crandall of the Bell Telephone Laboratories on the technical side. We were given a demonstration by Dr. Engl of the reproduction of the records which he had made with his apparatus, and he explained the apparatus to us, and told us the special points upon which he claimed merit.

The reproduction was very unsatisfactory; it was not of good quality. He had considerable

difficulty on making the apparatus function. The type of recording or the methods he used or the individual units of apparatus which he used in recording and the roproductions were quite at variance with our own development work, and quite at variance with our own ideas of the correct line of development work.

Q13. That is, you, before you saw any of this Engl apparatus, knew of the Western Electric development? A. Well, I was quite familiar with it. It was part of my responsibility to follow 986 that and deal with it from the commercial angle.

Q14. What had the Western Electric Company done, as far as you know, with reference to the film, the sound on film method? A. They had successfully recorded the sound on film and had recorded it in the laboratory. We had not yet at that time produced it commercially.

Q15. Was it the laboratory work on that you had seen? A. The laboratory demonstration.

Q17. Did you compare that with what you saw of the Engl work. A. I should say that Fox-Case was recording at that time with their 987 own apparatus in which a lot of the elements had been supplied by us.

Q18. Was recording the sound on film? A. Sound on film.

Q19. So recording sound on film was known to you, that is, you knew what the results were before you saw this Engl work? A. Yes, sir.

Q20. And when you say the sound on film, the sound was on what film as reproduced? A. As reproduced the sound was on the same film with the picture, and alongside the picture, pictorial record.

988 *Whitford Drake—For Defendant—Direct.*

Q21. Do you know how the sound and picture negatives were taken? A. In the laboratory work we were using a separate negative for such recording? One for the second and one for the picture; Fox had been doing much of their work on the same film. Either at that time or about that time in their studio they used two films, two negatives, one for the sound and one for the picture. Then they bring them together on the positive.

989 Q24. You were talking about the rather poor quality of reproduction in Mr. Engl's apparatus, I want to know what standard you had to compare it with. A. We had two standards to compare it with. One was the commercial apparatus we had in the field, that is, the disc record and disc reproduction, and the other, of course, was the laboratory standard on the film side.

Q25. And the results, as you had observed them, on the Western Electric work of sound on film, how did they compare with the sound
990 on the disc? A. About the same.

Q26. How did both of those compare with what you saw in the Engl demonstration? A. Much superior; even the Fox recording, with their flashing lamp, was in my judgment at that time away ahead of anything that Engl could show us in 1926 or 1927.

Q27. Mr. Joy said, I think it was testified yesterday, and then I think we communicated with you, until then did you know that you had sat on any committee in 1926 and 1927, with the Fox representatives? A. I did not, I had met them, talked these matters over at their

solicitation, but there was no formality, there was no organized committee.

Cross Examination by Mr. Ward:

The Fox people invited me up to inspect the so-called Tri-Ergon system; and at that time through the Vitaphone Company, we already had a license with the Fox people. At that time, the Vitaphone Company was commercially putting out or about to commercially put out the disc record system. They had not commer- 992
cially put out the sound on film system.

XQ33. I believe that Dr. Wente testified that some of the film system was experimented with in the laboratory prior to the disc system. Do you know anything about that? A. Only from hearsay.

XQ34. But the fact is they were out on the market with the sound on disc system, rather than the sound on film system? A. Yes, in 1926, at the time the Tri-Ergon system came over.

The so-called Case system was a sound on film system, and that Tri-Ergon system which 993
we were invited to inspect and view, here in December, 1926, if that is the exact date, was also a sound on film system. And we had been supplying the Fox-Case with what I call some of the Western Electric equipment, microphones, loud speakers, amplifiers and, at that time, I think they had an interlock system of ours.

XQ38. And this glorified so-called interlock system was nothing in the world but synchronous motors properly designed, electrically synchronous motors? A. synchronous motors of a special type.

994 *Whitford Drake—For Defendant—Cross.*

XQ39. Any two motors would be synchronous if they were operated electrically synchronously, would they not? A. If they are of the right type. Any of them properly constructed would be.

XQ41. This so-called interlocking was only putting two motors properly designed together, operated synchronously electrically? A. I do not know that I am qualified to give you a technical explanation of our interlocking system,
995 but it is rather more elaborate than that.

XQ42. Mr. Drake, it was decidedly to the interests of the Western Electric Company, was it not, that the Fox people should not take up the Tri-Ergon System? It was decidedly to the interests of your company that the Fox Company should not take up the Tri-Ergon System? A. I think not. They were already licensed by us, and whether they took up the Tri-Ergon system or not, made but very little difference to us financially.

XQ44. Do you mean by that you had them
996 tied up by a license for 15 years? A. Yes, sir. Our licenses run for 17 years.

XQ47. Does your contract provide that he may rescind it or cancel it, that the license may be rescinded or cancelled at any time, if he likes? A. I do not recall. I would have to take the contract and go through it.

XQ48. Don't you know that it does not so provide? A. Not that early contract, I haven't looked at that for some time. My recollection is it did not have a terminable provision.

XQ50. Notwithstanding the fact that you had the Fox-Case Company signed up on a 17 year

contract, wasn't it still to your company's advantage not to have them take up this Tri-Ergon system? A. At that time we did not, because I was representing our company commercially, and that phase of it never entered my head. 997

XQ51. You had patents or were seeking patents on your own system of reproduction for these things, and you had done developmental work, along a particular line, and it would have been rather embarrassing, would it not, to have to digest a different system brought over by those people, and exploit it? A. Not at all embarrassing at that time. We had not gone out with the film system. 998

XQ52. It would not have embarrassed you at that time, because you had not gone out with the sound on film system? A. Not commercially.

XQ53. When this system was brought over here, your engineers and yourself were given complete access to it, were they not? A. No. My recollection was that we were not permitted to examine in detail certain parts of the apparatus; that we relied mainly, as far as my contact with it was concerned, on statements made to us by Dr. Engl and by a merely general exhibition. I think we were not permitted to look into the amplifier very closely. That is the only part I recall at the moment. 999

XQ57. You were given complete access to the camera for taking the sound pictures, the reproducing machine for reproducing them? A. I do not know quite what you mean by complete access. We were shown the camera. And Dr. Crandall was shown the camera.

XQ59. And you had shown your system of

1000 *Whitford Drake—For Defendant—Cross.*

taking the sounds and pictures on separate films, and then developing each separately and printing on the same film? A. I do not recall that we were shown any actual operation of the equipment, except the reproducing equipment. As far as the recording was concerned, I do not recall that we were shown any of that.

XQ60. Was any sound on film which had been made by Western Electric at that time actually compared in test with the Tri-Ergon rec-
1001 ords that you saw alongside of each other? A. No. Not at all, that I recall the comparison between the two was based on my knowledge of my company's laboratory experiments contracted with what I saw up there at the Fox studios.

My company did not undertake to bring any sound on film records down there to compare with the Engl or Tri-Ergon system, for the others to investigate the matter and to make any decision on, that I recall.

XQ65. How many licensees in December, 1926,
1002 did the Western Electric Company have approximately on the sound disc system? A. Well, first, our licensees are not confined to either system, they are broadly licensed. In 1926, they were licensed for the disc system, and not that alone, they were licensed for any system or broadly under anything we had at that time. We had one licensee using the disc system, and one licensee using the film system.

XQ67. You had a licensee using the film system when? A. In December, 1926. That was Fox-Case. They actually used the lamps manufactured by Mr. Case, and used the recording

apparatus developed by Fox-Case or Mr. Case, I do not know which. What they were using of the Western Electric Company at that time, under our license were our Western Electric amplifiers and loud speakers, microphones, and similar apparatus; practically everything they used with the single exception of the lamp itself in the camera and the camera mechanism was furnished by Western Electric. 1003

XQ71. And the system of recording and reproducing the sound, that was not furnished by Western Electric? A. The greater part of the reproducing system was furnished by us. I think the pick-up mechanism at that time was a system they had built themselves. 1004

XQ72. What do you mean by pick-up? A. Where the sound is taken off of the film record, they were using our photo-electric cell and photo-electric cell amplifiers, and the remainder of the system was Western Electric.

XQ73. How many licensees for the sound on disc system did you have in 1927, and by licensees, I do not mean in the technical sense of having a direct license, but generally licensees using the sound on disc system? A. Only one throughout 1927. 1005

XQ75. When did you have any number of licensees for sound on disc, using sound on disc? A. 1928.

XQ76. 1928; and throughout 1927 you had two licensees only? A. Correct.

XQ77. One the Fox Case using sound-on-film which Mr. Fox or the Tri-Ergon Company brought to them—

1006 *Whitford Drake—For Defendant—Cross.*

Mr. Neave: Wait a minute; that is wrong.

Mr. Ward: He will correct me if I am wrong.

XQ78. And the other — some other company using sound-on-disc? A. The Vitaphone Company using sound-on-disc.

XQ79. Was anything wrong in my question that Mr. Neave took exception to? A. Yes. The
1007 Fox system of recording and reproducing bore no relation to the Engl system at all, as I saw it.

XQ80. Who brought them that system? A. You mean the Fox Case system?

XQ81. Yes. A. Well, as a system it was made up of various Western Electric parts, and in fact it was developed around Western Electric amplifiers.

XQ82. What Western Electric parts? A. Amplifiers, loud speakers, microphones. The particular contribution of Fox, as I recall the story, was the lamp itself and its application to a
1008 camera.

XQ83. And when was it that Western Electric had any other licensees than Fox Case using the sound-on-film system? A. As soon as we licensed the remainder of the producers in 1928 they were supplied with both systems.

XQ84. So the fact is that you had access to the Tri-Ergon and the Case system in December, 1926, and you got out your sound-on-film system in 1928, in a substantial commercial way? A. No, we had furnished Fox with apparatus in 1927.

XQ85. I said in a substantial commercial

way. Did the Fox Company use your sound-on-disc system in a substantial way? A. No, they never used that.

XQ86. Referring to the committee, were you and Dr. Crandall and Mr. Joy and Dr. Engl, did you meet and discuss these matters from time to time? A. I do not recall meeting from time to time. I think we were given this demonstration and had one evening meeting; as far as I know, that was the extent of the meetings, and I think we had one discussion either before or 1010 after that, to my recollection. I gave no formal report to anybody.

XQ89. You didn't participate in giving any report to anybody? A. Any report I may have made was—I may have had some verbal discussion with Mr. Courtland Smith representing Fox, I certainly discussed it with my own organization and told them my impressions. I can't recall my conversation with Mr. Smith, but presumably it was the same as I gave my own people.

XQ91. Was it not your custom or Dr. Crandall's to prepare data and file memorandums on 1011 these kind of conferences that you had? A. Not informal conferences. I do not know where Mr. Neave got all the details that he cross-examined Mr. Joy here on with respect to certain features of the Tri-Ergon machine and system. I have no data that I took at that time which he may have looked at, but I do not know what Dr. Crandall had.

XQ94. In the latter part of 1926, what parts of a complete sound-on-film system did the Western Electric put out? Take the recording first

and then the reproducing. A. We had furnished all parts of a complete sound-on-film recording system with the exception of the light valve, because we had not advanced that at that time to any commercial degree. We had no printing apparatus at that time; we never have had that. We did furnish loud speakers, amplifiers, motors, interlocked system, speed control mechanisms, not the cameras. We had not put sound heads for reproduction out at that time. We do not use
1013 a sound head for recording in that type of system. We use a separate machine. We had not then furnished separate machines for recording sound to our licensees.

XQ105. December, 1926, you were not in a position to put out this apparatus that I have mentioned, were you? A. We were in a position to manufacture it and put it out if there had been a demand for it. We had not done it.

As to how familiar I was in 1926 with the technical end of my company's affairs with respect to sound on picture work, I knew, of
1014 course, in a general way the general direction of development, but I am not a technical man in that class of work.

As to whether data supplied to our company of a technical nature with respect to sound and picture reproducing or recording came before me, our technical information came from the laboratories, the Bell Telephone Laboratories. I was the point of contact between the commercial side of the laboratories, but I was not in the laboratories.

As to whether data pertaining to this subject of a technical nature submitted to the Bell Lab-

oratories would be brought to my attention, it might or might not, depending on how it came.

I had first heard of this Tri-Ergon system in December, 1926. I had never heard of it before that, never heard of the name Tri-Ergon; never heard of Dr. Engl.

Re-direct Examination by Mr. Neave:

I said that these conversations that I had with Fox interests were initiated by the—various suggestions that we might take an interest with the 1016
Fox Case people in this Tri-Ergon and furnish part of the money, were initiated by the Fox Case people, that is correct. We did not take an interest with them and furnish some of the money.

Re-cross Examination by Mr. Ward:

The Western Electric Company or its affiliated companies became rather intimately tied up or related with the Fox Company not long after December, 1926, in a financial way. The Fox 1017
companies were under considerable obligation to them financially, some time after December, 1926. I would have to check my records as to just what took place. My recollection is it was in 1929. That is my recollection, but I would like to check my notes.

We supplied the Fox companies with substantial quantities of recording apparatus from 1926 on. We furnished the first large quantity of reproducing apparatus, not directly to the Fox Company, but to the theatres in which they were showing their product, in the early summer of

1018 *Lloyd A. Jones—For Defendant—Recalled—Direct.*

1927. As to the amount of that apparatus supplied in 1926 and the early part of 1927, I do not know. The volume of business from the Fox angle was not so large as it was with some others, and I really do not recall what the exact figures involved were at this time.

RXQ125. When did you first install in the Fox Studios your sound-on-film recording apparatus? A. We had portions of our apparatus supplied
1019 to them—

RXQ127. I do not mean the portions, I mean including the light valve and everything. A. I think the first light valve installation was in 1927.

RXQ128. When did you first install in the Fox laboratories your first reproducing apparatus? A. I do not recall that, it presumably must have been somewhere about the latter part of 1926, because they were equipped with and had some of our apparatus, but I cannot say again that that was complete.

1020 RXQ129. You understand I am talking about complete apparatus, complete sound-on-film apparatus. A. My recollection is that was in the spring of 1927, early spring of 1927.

LLOYD A. JONES, recalled.

Direct Examination by Mr. Neave:

Q848. I understood you to say that the average number of striations in the sound record

such as the defendant uses would be about a thousand to an inch or per inch. To what frequency would that correspond? A. That would correspond to a frequency of 18,000 cycles per second. It is rather high.

Q850. How many striations per inch are there really used, and up to what frequency does that mean? A. Well, at one-quarter of that, at 4500 cycles per second, it would be 230 lines per inch.

Q851. Is that more nearly the average than 1022
1,000 lines per inch? A. I should say in the commercial installations of the present time that 250 lines per inch is fairly well up towards the top.

Q852. Does that take care of all the frequencies that you need? A. I shouldn't say it takes care of all you need; it takes care of about all we get.

Cross Examination by Mr. Ward:

XQ853. You understand my question when I 1023
said the average, in my question. A. My mental arithmetic was defective.

XY854. Was it your mental arithmetic or have you had better information since you left the stand? A. I had the information when I was on the stand.

XQ855. Have you spoken to somebody about it since you left the stand? A. Yes, I have. Mr. Neave asked me about it, and when he asked me about it I realized that my mental arithmetic was defective.

1024 *Lloyd A. Jones—For Defendant—Recalled—Cross.*

The film travels through the projector at 18 inches per second for a frequency of 18,000 cycles per second you would have to have 1,000 lines per inch. For a frequency of one-half of that or 9,000 cycles per second you would have 500 lines per inch. For a frequency of half of 9,000, or 4,500, you would have 250 lines per inch.

XQ857. What is the average figure that you
1025 now want to adopt? A. Well, if you insist on the average, I should say the lowest frequency that comes through the usual commercial system is probably about 50 cycles per second, and the upper frequencies—of course, there is not a definite line of cut-off, you must understand that.

XQ858. I do. A. I should say that 6,000 certainly represents a very optimistic estimate of the frequencies. Now, the average of 50 and 6,000 would be 3,025, so that brings it down still lower as to the lines per inch, which is the
1026 average frequency, so the average would be under 200 lines per inch.

Mr. Neave: Mr. Drake, do you recall, told you that he couldn't quite remember when it was that Electrical Research Products made some financial arrangements with Fox, but thought it was 1928. He has just told me now that he thinks he was incorrect in that, and it was 1929.

May we assume that that is changed?

Mr. Ward: Yes.

Edward C. Wente—For Defendant—Recalled—Direct. 1027

EDWARD C. WENTE, recalled.

Direct Examination by Mr. Neave:

As to whether we ever reproduce from two films, one positive film for the sound, and one for the record, using two machines for reproducing, that is done quite frequently. There probably have, from time to time been certain pictures put out by the two film method. The reason for doing that is, they want to get the optimum sound space and picture space, so they 1028
can treat the positive sound records separately and the picture negative separately. In one picture like "Hell's Angels," there were quite a good many sound effects, and the producer there wanted to get the best results that they could possibly get, and they put in quite an investment in the production of the picture, and in the larger cities, the principal points of interest, why, they were put out on two films. Then the sound record was the whole width of the film.

Q91. And the picture record was— A. No, I beg your pardon, the sound record was not the 1029
whole width of the film. The picture record was the whole width of the film.

Q93. How much of the film was taken up by the sound record? How much of the other film was taken up with the sound record? A. I do not believe that I can answer that. My impression is that it was about the same width of track as they use when they print on the common positive.

Q94. And do you also use these two films for reproducing and running simultaneously in previews? A. In pre-views it is done almost exclusively that way.

1030 *Edward C. Wente—For Defendant—Recalled—Cross.*

Cross Examination by Mr. Ward:

XQ95. Dr. Wente, do I understand you to testify in substance that the Western Electric Company had developed loud speakers and microphones to a high degree of perfection before sound pictures were seriously taken up for theatre use; that is to say, prior to 1918? A. I would not say that they were perfected.

XQ97. I just want to get the date. They were
1031 developed to a high degree of perfection, not necessarily completely perfected; that is, you had loud speakers and microphones well developed for commercial use prior to about 1918? A. Well, in 1918, we had microphones, condenser microphones, that I perhaps should not say that they were developed for commercial use, because they were not used very extensively. They had not gone through any commercial tests, service tests but they were microphones of good quality, and under proper supervision would perform satisfactorily. The loud speakers that we had
1032 at that time were quite satisfactory from the standpoint of speech. They did not give sufficient volume to be used in a large theatre for the reproduction of music and particularly as regards the high and the low frequencies that they have to reproduce in the case of music. Amplifiers also were not nearly of the same high character to which they were developed later on. They have been in almost a continuous state of improvement.

XQ98. What I was trying to ask you was, as a general proposition, whether you had these things, such as loud speakers and microphones

perfected so that they were thoroughly commercially satisfactory in about 1918 or 1919? For commercial work, other than talking pictures? A. For certain types of commercial work, yes. For communication purposes.

XQ101. And it is your contention that by 1925, say, you had loud speakers and microphones and amplifiers developed to about as high a degree of perfection as anybody else in this country, or better? A. I think that is true. My company started developing these devices for communication service before they undertook sound picture work at all.

XQ103. So that when people began to get seriously agitated in this country about production of sound pictures, your company was in the position of having these auxiliary equipments which were needed; is that right? A. We had the auxiliary equipment in a rather satisfactory state as far as performance was concerned, and I think they were in a state where they could have been used for the production of talking pictures successfully commercially.

XQ104. Then it is your testimony that this auxiliary apparatus of microphones and loud speakers were not in a satisfactory state in 1926 for sound picture reproduction in theatres? A. In 1926, I think they were satisfactory, because talking pictures were then produced and have since remained as a permanent adjunct, the sound as a permanent adjunct to the picture.

XQ.106. Then am I correct in saying that in 1926, this auxiliary apparatus, such as loud speakers and microphones and microphones and

amplifiers that your company had were as good as or better than those of anybody else? A. I think it was better.

XQ107. At page 513 of your testimony, you say that you devised and developed the condenser microphone. You don't mean that you were the originator of the broad idea of a condenser microphone, do you? A. In general, you might say there are three types of microphones:
1037 There are microphones in which you have a variation in resistance and those in which you have a variation in inductance, and those in which you have a variation in capacity, and those three possibilities were, of course, immediately evident from almost the very beginning of telephony, but as far as I know they never had been, up to that time, even though there had been publications on condenser microphones, as early, I believe, as 1880, a suggestion of it, but they could not have operated without the use of an amplifier; it was the amplifier that made it possible, and not the condenser microphone idea
1038 *per se.*

XQ109. What you mean is that you made certain specific improvements on the principle of condenser microphones? A. The only principle of the condenser microphone as a general principle of having one plate fixed and the other one movable, that, of course, I did not originate. What I did, I was the first to use a stretched diaphragm for one of the plates, and to put the fixed plate in very close juxtaposition, not in juxtaposition, but in very close relation to the moving diaphragm, and proportion the dimen-

sions of these, this fixed plate, so that the diaphragm would give, act uniformly throughout the audio frequency range, just using, say, having one movable plate and one fixed plate may give an instrument which will respond to sound waves, but it is a long way from that to where an instrument can be used, can be said to be a microphone of anything like good quality.

XQ110. The general position of the two plates, and so forth, except from these details of what 1040
you term stretching and particular locations and arrangement, were old? A. It was as old as 1880.

XQ111. What did you say caused them to be made possible in motion picture use, amplifiers, did you say? A. In general. Audion amplifiers, well, yes, I should say audion amplifiers. There may be other amplifiers that would make it possible to, but the audion amplifier is particularly suitable for use with a condenser microphone. That was Dr. DeForest's work, and others, of course, the associate circuits, and the methods of 1041
connecting the condenser microphone to the audion is part of the problem.

XQ114. At page 515 of your testimony you stated in substance that in 1920, you commenced the study of sound records by the variable density method, and decided to use the form of light previously used by Professor Rankine; is that right? A. The form of light modulating device, I should have said there, if I didn't. I never heard it referred to as a light valve; I think the term that Rankine used was photophone, but as a matter of fact, it was generally the light valve,

1042 *Edward C. Wente—For Defendant—Recalled—Cross.*

it was a light modulator, yes. You can call it a light valve. The only thing is in the literature you will find that the light valve, as distinguished from other light modulators is a particular kind of light valve, which has gone into very wide usage. I do not think it is a trade mark. I do not know whether our company has put it on it.

1043 The Court: He says that was an accepted designation.

The Witness: You will find it in foreign literature as well as in this country.

As to whether Eugene Laust devised the light valve for sound recording prior to the commencement of my work in 1920. The light valve I think was used by Laust, and the light valve is in a certain sense, a string galvanometer device with particular arrrangement of ribbons in the magnetic field, and the formation of the light slit, and the construction of this instrument in such man-
1044 ner that it will have a uniform frequency of response, however, I do not believe was disclosed previously.

I was present at the taking of the testimony in the case of the General Talking Pictures Corporation vs. Stanley Company, in Delaware, the case being tried in 1930.

I heard Laust testify there as a witness on behalf of the Western Electric.

XQ1213. Do you know that he testified there, that he used a light valve for recording sound long prior to your date of 1920? A. I do not remember that; he may very well have, though.

Edward C. Wente—For Defendant—Recalled—Cross. 1045

Mr. Ward: May I just hand the witness this page to refresh his memory?

The Witness: The question.

XQ124. I just want you to read it. A. "I started the light valve and I am too busy, and I give up." Is that what you mean?

XQ125. Yes. A. I don't know whether that means he gave up the light valve. As I remember Laust used the light valve also to make a 1046 variable area record, but I am not sure.

XQ126. Your company's employes have published a number of articles, haven't they, on the use of the light valve by Laust some years back? You have seen such articles, have you not? A. I am not certain that I have; I can't recall the substance of the articles.

XQ127. You say that you completed your work on the light valve by early 1923, is that right? A. Well, by "completed," I meant that by early 1923, we had completed a model which we used for the recording of sound-on-film. 1047

As to when I got my light valve sufficiently perfected so as we were ready to turn it out for recording sound in a commercial way, of course, I am employed in the research department, and about the building of these valve, I have no say about as to whether the conditions they are in are suitable for commercial production or not. But so far as the performance of the valve was concerned, it would be a very easy matter to put it in commercial production at that time, 1923. There has been no substantially fundamental change in the valve from that date.

XQ130. We may differ on what you call funda-

mental. Your position is such certainly that they would take your advice as to when it was ready to be put out commercially, that wouldn't be left to the commercial department? A. Well, I would have some say about that possibly.

The commercial department would have something to say about it, whether it is in condition to go out commercially. I meant we have a department which is called the apparatus develop-
1049 ment department, who have charge of the design of apparatus, putting the design of a piece of apparatus in such shape that it can be put into the factory for production.

In a general way, my function is that of research engineer in a purely laboratory way, and when I think I have a problem solved from a research engineer's standpoint I turn it over to these commercial development engineers to design for commercial use.

XQ135. When was it that the light valve left your research department and was transferred to
1050 this commercial engineering department to be designed for commercial use? A. Just in that sense that never took place, and that is true in a great many cases. For instance, in the light valves, we have continued to make improvements in the light valve from certain standpoints from after the time that the commercial or the apparatus development department began to work on these commercial productions of light valves. For commercial production the valve was used first in the transmission of pictures. Now, I do not have the date as to when the first commercial transmission of pictures was inaugurated by the Bell system, but the valve which they had used

for sound recording we modified so that it could be used for the transmitting of pictures, and the valve was developed or was modified for that purpose so that it could be made in the factory.

It is not right that we developed the light valve specifically for the purpose of transmitting pictures rather than recording sound, in the beginning we developed the light valve first for the recording of sound.

But it so happens that we first used it com- 1052
mercially for the transmission of pictures.

XQ139. Then don't you think it is a fair inference that it was not, in the opinion of your company, fitted for the recording of sound until some later date? A. I don't see how you can make that inference necessarily.

XQ140. Did you use it for the transmitting of pictures first, or for the recording of sound first, in a commercial way, in each case in a commercial way? A. Used it for the transmission of pictures first in a commercial way.

XQ141. Why did you not use it for the trans- 1053
mission of sound first when you say you started out developing it for that purpose, for the commercial production of talking pictures? A. There were quite a large number of problems that had to be worked on in getting the apparatus for the recording, of the study of film emulsions, quite a lot of work we did for several years there, and the question of the transmission of pictures came up at a time when the American Telephone & Telegraph Company said that they wanted to transmit pictures and put it up to the engineers at the laboratories to devise a method for doing it which would be commercially suc-

1054 *Edward C. Wente—For Defendant—Recalled—Cross.*

cessful, and a good deal of effort was directed towards the accomplishment of that object.

I cannot give the year in which the light valve was first used commercially for transmitting pictures. I have no data on that. It was not used in 1926 commercially for pictures, because the pictures that were brought out in 1926 were with the disc.

As to when it was first used commercially for
1055 sound on film with respect to sound pictures, that is a question that I cannot answer very definitely either, because of the fact that most of that work was done not in the Apparatus Development Department. I know that in 1926 they made some pictures and records, and in 1927, at the Fox Case Studios, they had light valve recorders, and they made some short subjects there, but just what subjects were shown in the theatre, I could not say.

It would be around 1927 or 1928, I think in the early part of 1927 is when Fox was the first to
1056 show any sound—Fox did not use light valve, but I mean it could not have been before that. It may have been in 1928.

I first made a sound picture record in our laboratory, in 1923. I actually made the picture record at that time as well as the sound record.

I first actually reproduced sound pictures in our laboratory in 1923.

XQ153. Then in your direct testimony at page 517, with reference to making sound records on picture film in 1922 experimentally, you had reference there to making the sound record on a sound picture film, not on making sound picture records in 1922? A. Yes; that record was made

with the Rankin system, and we were interested in mainly getting the sound—

XQ154. And at page 517 of your testimony, you testified, in substance, that you made sound records and picture records on separate film and kept them separate throughout, both for recording and for reproducing. A. That is right, that was in 1923. In taking those sound picture records on separate film, I took them synchronously or simultaneously.

XQ157. In order to refresh your memory more 1058
nearly to the particular date when you did that, do you recall testifying in the Delaware suit that I referred you to, that you said that by the latter part of 1923 you made the synchronous picture and sound record? A. I have the date here as April, 1923,—I beg your pardon, that is right, October 1923. October, 1923, is the first date I did that even in the laboratory.

XQ159. Referring to your testimony at pages 565 and 566, with respect to 87 to 94 in this suit now—with regard to reproducting from two films, one sound and one picture, you said that was done 1059
quite frequently, and later on you testified that it was done from time to time on certain pictures.

Can you tell us a little more definitely how extensive that entirely separate sound and picture system that you are referring to there and to which I have already referred you elsewhere, is being carried out by your company's licensees today? Is it not a fact that it is a very minute per centage of the total sound picture production? A. Well, I don't know how minute. As late as October 30, 1931, there was an installation in a theatre in Los Angeles, and in quite a

number of places, "Hell's Angels" was reproduced that way, and some other pictures—That theatre in Los Angeles, I have as the Forum.

There are literally thousands of sound picture theatres in the country.

I would say that the use of this separate sound picture system throughout which we are talking about is the exception today rather than the rule, it is not the rule.

XQ163. And perhaps you can tell us what was
1061 the type of the film in which this separate film system throughout was used in this California theatre. What was the picture in which it was used, the name of the picture? A. Oh, in California, that I don't know, not this last installation. For all I know, it may have been one where it had to be done that way for special reasons, possibly so.

XQ166. You simply know that you have a note there that that is one theatre in which this system that you are talking about was run? A. That was one theatre that I mentioned that was in
1062 1931. In 1930 however, there was quite a number of theatres; some dozen or so, anyway. A dozen or so against thousands for the other system. I have obtained these notes for general information on these few theatres in which these separate films are run. They were compiled especially for use in this testimony.

XQ170. To show that at least there have been a few cases where separate films have been used; that is the object of the notes, you have had compiled for you, is it not? A. I don't know—

XQ171. You would not have that data for your regular run of work, would you? A. No, I am

not in accounting department, to keep track of them, that is true.

XQ172. Those instances you have there are Western Electric equipment instances? A. Those are of Western Electric. There may be other theatres that use separate films installed by other manufacturers, of which I have no record.

XQ173. At page 527, Q37, etc., you were questioned about when was the first time that you, in the laboratory recorded sound and pictures on 1064
separate films and then printed the sound and picture records on the same positive film. And you testified that you thought it was 1925. Was that 1925 or 1926 that you did that? A. Well, I did not have any exact data on that, for the reason that I am, as I said before, in the research department, and although we did make a sound and picture record in 1923, we did after that very little in the way of getting a sound picture, because we had at that time tested the means of synchronization which worked satisfactorily, and there was not really any point in our department 1065
making any further pictures, sound pictures. We devoted all our attention to the making of and the improving of the record. Whether we were going to have pictures with it, in what manner, whether on the same film or on different films, that was thoroughly evident we had no concern with—

XQ174. But you have very definite data as to when you first took the sound and pictures simultaneously and separately, and kept them separate throughout, have you not? You have testified definitely on that. A. Yes.

1066 *Edward C. Wente—For Defendant—Recalled—Cross.*

XQ177. Why have you not got data as to when you first took them simultaneously and separately and then later printed them on common positive stock? A. Well, I got this data on the theatre installations from the Electric Research Products Company, who have in their department, keep close track of it, check of what is going on commercially. However, what is done in the laboratory, we have to check through with
1067 other engineers and through note book records, and I have not done that with the Apparatus Development Department. We, in our department after 1923, I don't believe ever did make any other sound pictures—

XQ178. Are you testifying from hearsay knowledge here in these matters you are talking about, data given you by somebody else? A. In the Apparatus Development Department. That is the reason I could not state definitely as to when that combined picture was made. But I have their information—

1068 XQ179. I want you to confine yourself to your personal knowledge now, please. You have testified here— A. What I have observed myself, when I have seen them make combined records. That I have never seen.

XQ180. You have never seen in the laboratory of the Western Electric Company or did not yourself take the sound and pictures simultaneously on separate films and then print from them two negatives onto one or the same positive film? A. We only made one or two pictures that I had anything to do with directly, and we made the picture record on one film and the sound record on another, and then we projected this, using

1069

the same machine for reproducing that we did for recording. We did not actually go through any of the printing processes because that was thoroughly obvious and had nothing to do with getting—

Mr. Ward: I object to the volunteered part of his statement.

XQ181. The answer, then, to my question is "No," is that right? A. No, we did not do that. 1070

Mr. Ward: May I amend that question by saying "Western Electric Company or its affiliated companies"?

Mr. Neave: Will the answer be the same?

XQ182. Will your answer be the same if I say "Western Electric or Bell Laboratories or the Electrical Research Products Company"? I just used the broad term "Western Electric" generally. A. The answer is "No." 1071

Mr. Neave: Is you answer the same if you include these other interests of Western Electric, the Bell Telephone Laboratories, and Electrical Research Products?

The Witness: Yes.

XQ183. That is, the answer is "No"? A. That is, I haven't actually been in any of the laboratories of these people or seen it made there; I have not been there when it was being made.

1072 *Edward C. Wente—For Defendant—Recalled—Cross.*

XQ184. When to your knowledge did the Western Electric or your affiliate companies or any of its licensees take sound and picture records simultaneously on separate films and then print onto a single positive? A. Well, I can't answer that question any more than I answered the other one.

XQ185. Then all of the testimony you gave with regard to dates along that line was from hearsay? A. As far as I have personally seen
1073 or taken the records and personally printed them, I haven't done that.

When I, in the laboratory, took the sound and pictures on separate films and kept them separate throughout, the stock which I used for the sound records at that time, in 1923, was negative stock, the same as the picture stock.

As to those sound and picture records when they were taken on separate films and kept on separate films, I do not know whether I personally developed them, but I saw them being developed, they were developed separately. They
1074 would be developed in a different developer. The reason why we developed them—there is one reason we couldn't develop them any other way, that is, the facilities that we had was a tray developer. We developed one strip of film in a tray, and we would throw that out and make fresh developer for the other film.

I don't know whether we used the same developer formula for each.

XQ194. You do not know what the developer was, whether it was the same developer or a different developer, but you do know because you had only one tray or the facilities of one tray, you developed the sound track, and then after-

 1075

wards you threw that out and put some more developer in and developed the picture track? A. That is my recollection.

Those strips of film that I made in 1923 with the sound and pictures on separate film were 200 feet long.

I think we made about two or three trials of such records of sound and pictures in 1923 on films.

I have no recollection that we made any sound 1076
and picture records in 1924, because we were working with the sound principally.

As to how many times I made sound and picture film records in 1925, from 1923 on, that part of this work was being done in the apparatus development department, gradually more and more of the work was being carried on over there, and as far as I can recollect now, I am not sure whether we made any more picture, sound and picture records; I am quite positive that we did not.

XQ199. As far as you know you have no 1077
knowledge of doing any more of that work in making sound and picture film records, sound and pictures, until after 1926? As far as you yourself personally are concerned. A. I do not know what the 1926 is for; I do not believe even after 1926 I made any.

As to whether I saw sound and picture film records made, I have seen them photographed. In 1926 I saw them make some of the Vitaphone pictures. But those were disc records. I didn't see them make any film records in 1926.

XQ206. When do you personally know that the first commercial use was made of the method of

1078 *Edward C. Wente—For Defendant—Recalled—Cross.*

taking the sound and picture simultaneously on separate strips and continuing the separate strips throughout to the projection, by you or Western Electric or its affiliate companies? You understand I am limiting it now to the sound and pictures being separate throughout, taken separately? A. I am trying to get straight in my mind as to how much I saw of this, if you are going to limit the question to actual seeing.

1079 XQ208. Saw or know of by personal knowledge, not by reading something or by hearsay. A. Or by hearsay. I do not know that. From a source which I think to be reliable, I understand it was in the early part of 1927.

XQ210. From knowledge other than your own, you believe that it was early 1927, that your company or your affiliates first took the sound and picture on separate films simultaneously and developed them and kept them separate and reproduced them on separate films? A. I think that is probably as far as the commercial pro-

1080 duction was concerned.

XQ211. Now, as a matter of fact, was that done at all in 1927? A. Well, that is, as I say, I haven't—I only know with regard to the Fox Case that we supplied them with apparatus for interlocking—

XQ212. Hasn't testimony been given here that Fox Case did not use your system for recording its films, or am I wrong? A. I do not know whether they used it commercially. They had light valve recorders at least the first part of 1927, in the Fox Case Laboratories, and they made, if my information is correct they made pictures by both methods for comparison purposes. They were licensed in December, 1926.

Edward C. Wente—For Defendant—Recalled—Cross. 1081

XQ213. Of course, receiving a license hasn't got anything to do with what they were actually using. They received a license also to record on discs, didn't they? A. I believe they did. I do not know personally that Fox didn't record on discs in 1927.

XQ215. Do you know whether in those instances that you referred to of Fox Case or Fox in 1927, that they used the single system throughout, took the sound pictures on one film, developed and kept it on one film and projected it? 1082
A. I only know that the picture "Sunrise" was a scored picture, and in that case they would have to use two separate films.

XQ216. But they wouldn't be simultaneously taken, would they? A. It wouldn't be simultaneously taken,—did your question state that?

XQ217. I may not have, but that was a scored proposition where they had to be taken separately. A. Then I do not know.

XQ218. As a matter of fact, you really do not know what system the Fox Case people were 1083
using in taking their films and reproducing them in 1927? A. I know they were doing a good deal of experimenting at that time, and we supplied them with various kinds of equipment for connecting their recorders and cameras, and our engineers spent—this I know—spent a good deal of time up there.

As to the theatre demonstration that I testified about, given by Fox Case in the early part of 1927, I do not know personally how they reproduced, as regards the sound and picture films, I have never been in the Fox Case Laboratories until quite recently.

Edward C. Wente—For Defendant—Recalled—Cross.

XQ221. I believe on your direct you testified that when you did take in your laboratory the sound and picture records simultaneously on separate films, you used on the sound film a narrow sound track rather than devoting the full width of the film to the sound track, in the recording at that time. A. Well, as we were then interested mainly in getting a good sound track we did actually use a sound track which is
1085 two or three times as wide as the one that is used at the present time.

XQ223. Then were you mistaken in giving your testimony in answer to Mr. Neave's question when you were recalled, at page 566, Q90, etc.: "A. The sound record was the whole width of the film." The next answer was: "No, I beg your pardon, the sound record was not the whole width of the film." The next answer was: "The picture record was the whole width of the film," and the answer at the top of page 567: "My impression is that it was about the same width of track as they use when they print on the com-
1086 track as they use when they print on the common positive." Referring in those answers to sound records again, what are the facts? A. Well, the facts are that the sound record that we made, most of them were about a quarter of an inch wide, but not all of our records were made of the same width. The standard width of the sound track that I referred to is about 100 mils, it is a tenth of an inch.

When I used the separate film for the sound record in our laboratory work I used one-tenth of an inch and a quarter of an inch, other widths, too. We went up at least as wide as a quarter of an inch, not appreciably wider.

Edward C. Wendt—For Defendant—Recalled—Cross. 1087

With regard to the list of installations put on the record with respect to my testimony, pages 534 and 535, this list is supposed to represent 25 theatres in which the Western Electric film equipment was installed, referring to a system embodying sound on films.

XQ232. Have you any personal knowledge that these licensees were equipped at the dates indicated in this list with apparatus for either recording or reproducing sound from a sound film, 1088
or did you just get that list from somebody? A. I got this list from the Electrical Research Products Company, but I have checked this. This gives the date on installation, but I have checked the first, perhaps not all 25, but certainly the first dozen of them, against the records which we have in the laboratory as to the completion of the shipment of these.

XQ233. Then you know what apparatus is referred to in this list with respect to each of these parties, or don't you know? A. Well, that is the best knowledge that I have. I didn't per- 1089
sonally deliver these or even see these pieces of apparatus.

XQ235. Or inspect them at all? A. But I have the records from two sources which seem to check; that is the best I can say as to that.

XQ236. You have no personal knowledge as to whether these licensees installed or used the film or disc, have you? A. But I have another check here, I know that the Times Square Theatre did show Sunrise in September, 1924, and it was advertised as Fox Movietone, so that it must have had a reproducing equipment of the film type. That was in 1927.

1090 *Edward C. Wente—For Defendant—Recalled—Cross.*

XQ238. At page 536, direct Q81 to 83, you testified in substance with respect to the Times Square Theatre reproduction of 1927, that that was really the first all-sound production of the Fox system, and at Q83 you testified that the sound and pictures were on the same film. A. That is my understanding, yes, that that is correct.

XQ239. It is a fact, is it not, that with regard
1091 to the films shown there they were taken and reproduced on what we have referred to here at the trial of this case as the old one-piece system throughout, sound and picture taken simultaneously on the negative and then they developed the sound and picture together on one negative and printed on the positive; is that right? A. That is not right. I am quite certain, as the information I got from the Fox Film Corporation was that that was a scored picture. I did not see it myself, but they said that the picture had orchestral accompaniments and things of
1092 that sort, and in the review of the picture, why, it did, one would conclude from the reviews of the picture that that was a scored picture. I did not see the production.

As to whether I personally know anything about how the sound and pictures were recorded, I didn't see it recorded myself, but I have checked up with regard to our own engineers and with the Fox Company—

Mr. Ward: I object to that as hearsay.

The Court: That is all right; he answered, he said he didn't see it, but he checked it up.

Edward C. Wente—For Defendant—Recalled—Cross. 1093

The Witness: I did not see the positive film bearing the sound and pictures that the show was projected from.

I stated that in this theatre for that production they used Western Electric loud speakers, microphones and amplifiers for the recording. I have already stated that I did not see the recording, but I know that Fox Case under our license were using our equipment, as far as microphones and amplifiers was concerned, and 1094
that the installation at the Times Square Theatre was Western Electric installation. The Western Electric amplifiers and loud speakers, it is my understanding, were used there for reproduction. I do not know anything about a midnight demonstration given there before the show was thrown open.

XQ248. You wouldn't intend to contradict testimony given here that the first demonstration at that theatre did not have that Western Electric supplemental apparatus, would you? A. In the early part of 1927, I think— 1095

XQ249. In this same theatre. A. In this same theatre?

XQ250. Yes. At an earlier date?

XQ251. Yes. A. I do not know of any midnight demonstration.

XQ252. The first demonstration. A. I do not know anything about any midnight demonstration, no.

I was not at the Sam Harris Theatre.

XQ255. Now, I understood you to say that you did not see Dr. Engl in 1926, but you also say that you did not see any of his apparatus or

1096 *Edward C. Wente—For Defendant—Recalled—Cross.*

films at that time? A. I haven't stated in the testimony that I didn't see Dr. Engl. I did not see Dr. Engl in 1926. I have never seen any of his apparatus or any of his films. I don't know whether I have ever seen any of the Tri-Ergon patents until possibly a year ago, perhaps less. I don't remember ever seeing any of them.

As to whether I have read any publications in
1097 regard to the Tri-Ergon inventions, I have read —no—I may possibly at—no, none of the publications in regard to the Tri-Ergon inventions did I see, until, I should say, probably 1929 or something of that sort. I saw Engl's book for the first time, I think, perhaps about two years ago. I did not attend a convention in 1927 in Norfolk where Dr. Engl read a paper.

You ask if inventions are submitted to the Patent Department of the Bell Laboratories, whether it is customary for them to call me in to consider them; that would be very seldom
1098 that they would call me. I think I only know of two or three such cases. Normally, they would not come to me. They might come to my supervisor who might consult me about them.

XQ265. In the year 1925, did you hear anything around your department in regard to the Tri-Ergon inventions being submitted to the Western Electric or Bell Laboratories, in 1925, or any time? A. I don't know anything about that. They were never taken to me for inspection in any manner.

XQ268. As to your sound on disc system, which you say you got out commercially in 1925

to 1926, that was an improvement on the old Edison system that was put out by him about 1913 to 1915, was it not? A. Well, it was a sound on disc, and I think that 1913-1915, is probably a rather late date. I think from the very first of talking pictures, he tried to have a phonograph used with the pictures, from the earliest days of silent pictures. This sound on disc system with the pictures of ours, I think it is an improvement on that idea of Edison. There was no 1100
photographing recording of sound in our sound on disc system, that is in the simple disc system. Of course, in many cases at the present time, they do do both at once. In fact, in practically all—as far as I know, in all the film recording except news reel work, they do make a wax record at the same time. There is no photographic recording of sound in connection with our disc picture system when we do use a disc for the sound.

XQ272. I think Mr. Drake testified that as late as 1927, Western Electric and/or its subsidiaries 1101
had but two licensees. Now, at that time, did Western Electric or its subsidiaries have any patents on sound pictures, other than patents on amplifiers, microphones, loud speakers and such auxiliary apparatus as would have application to communication service? A. Of course, I don't have access to the patent—I mean, I do have access to the patent files, but I would not know of all the patents there might be. Of course, we did have a patent on the light valve, which is one of the elements you did not mention.

XQ273. What is the approximate width of the

1102 *Edward C. Wente—For Defendant—Recalled—Cross.*

fine slit used commercially through which the light traveling through the sound record is projected in reproducing sound? I would like to have the physical slit and then the width of the image of the slit in reproducing. A. My understanding is that it is two mils., two thousandths of an inch for the physical slit, and the projected image of the slit is approximately one-thousandth. That is about the standard for commer-
1103 cial practice. That is my understanding. That is what they used to use. That is what they used in the first installations and as far as I know that has not been changed yet, but it may have been.

XQ277. You have made, perhaps the majority of the contributions to the Western Electric group with respect to sound picture recording and reproducing, outside of what has been developed for communication service before Western Electric took up sound picture matters, have you not? A. I think I have stated pretty defi-
1104 nitely just what my contributions were. There are, of course, a great many other elements that have to be taken care of before a system, you might say, is functioning properly.

XQ278. You are perhaps one of the leading inventors in this particular art? A. That is, if you confine it to a certain period, let us say. During the period from 1920 to 1925, yes.

I testified at page 587 with regard to recording sound and pictures on different films that "Whether we were going to have pictures with it"—meaning the sound—"in what manner, whether on the same films or on different films,

that was thoroughly evident we had no concern with—" and at page 589 I made the following volunteered statement after I answered your question: "We did not actually go through any of the printing processes"—having reference to printing sound on pictures on the same film—"because that was thoroughly obvious and had nothing to do with getting"—those statements are correct. 1105

XQ281. When was this perfectly obvious? A. Well, in 1920, at any rate, we had considered the question of having the sound and picture record on a separate film for reproduction or on a single film. As far as the recording was concerned, we at all times felt that we should record separately and we always did so. 1106

XQ282. Well, was your statement intended to be one or not, that in your opinion this idea of taking on separate films the sound and picture and then printing them on one common film was perfectly obvious in 1920? A. Absolutely.

XQ283. Is it your custom when you file applications to read over your applications before you file them, the oath attached to the applications? A. Yes. 1107

XQ284. And is it your custom to colloborate with the patent attorneys of your company in the prosecution of the applications? If you get a rejection of your application, do they act on it as they see fit? A. I think they generally act on it as they see fit. I know some of my cases have been prosecuted in the Patent Office and that I really did not know anything about them and never found out just what took place as regards—

1108 *Edward C. Wente—For Defendant—Recalled—Cross.*

XQ286. But you do read the specifications and claims over? A. The original specification, yes; and I read my oath before I sign it.

My applications are assigned to Western Electric Company when filed.

You call my attention to a certified copy of a United States Letters Patent, No. 1,656,255, to Edward C. Wente, assigned to Western Electric Company, Inc., granted January 17, 1928, on an
1109 application filed April 8, 1924, entitled "Improvement in Talking Motion Picture Productions". I am the said Edward C. Wente.

The specification starts out with the statement that "This invention relates to the reproduction of variations of energy states, for example, the reproduction of changes of scene and concurrent variations of sound as instanced in the making of talking motion pictures." Then follows with certain statements of objects. One of these objects, "A further object is to obtain the desired contrast in the sound record on a posi-
1110 tive picture film without unduly limiting the control of contrast in the positive pictures."

Now another object, "Another object is to obtain a sound record on a positive picture film and yet permit the camera and the sound recorder employed in making the original sound and picture records to be moved about independently and also permit the same camera to be used without alteration for both talking and silent motion pictures.

"Another object is to obtain a sound record on a positive picture film and yet permit deletion of any portion of either the positive or the nega-

tive picture record without causing undue discordance between the pictures and sounds as finally reproduced.

"A still further object is to photographically print a negative picture record and a sound record onto a homogeneous record medium and yet permit independent control of the exposure of these records during the printing."

"In the embodiment of the invention specifically illustrated and described herein these various objects are obtained by recording the pictures and the sounds on two separate negative films." 1112

You direct my attention to original Claim 31. "A process of forming sound and motion picture records which consists of forming a photographic negative record of a changing scene, forming a photographic negative record of sound accompanying the scene, separately developing said records and thereafter printing said records on a single positive film."

As to whether in 1924, when I filed that application I was of the opinion that that was an obvious thing, yes, I was. 1113

XQ292. Notwithstanding you filed a claim for it and signed an oath swearing you were the original, first and sole inventor of that subject matter? A. Well, that patent application was written out on the basis of a memorandum which I submitted showing a method whereby you could run the sound record faster than the picture record, and subsequently printing the sound record down to a slower speed on a common film with the pictures. That is the only thing

1114 *Edward C. Wente—For Defendant—Recalled—Cross.*

that was in the memorandum that I considered original, and that is the memorandum that went to the patent attorney.

Now, if this particular claim—I had made no effort to make, I never supposed at any time, that this general problem of taking separately and printing at the same speed, that there was anything new in that, or I would have submitted it to the patent department, but they apparently
1115 broadened the claim to cover that.

XQ293. As a matter of fact, Doctor, there are a good many claims in this case that are not limited to that increase of speed idea, which you are correct is stated as a feature of the patent? A. As I say, this increased speed, if the patent solicitor has taken out of this, that this is broad enough to cover that, why, I do not see that, I wouldn't say it was new; I haven't searched the prior art, but I had never supposed that to be new.

XQ294. You told me that you read your speci-
1116 fication and claim before you signed your oath, and you have signed an oath here that you are the original, sole and first inventor. A. To the best of my knowledge. Of course, I cannot search all the prior art to see.

XQ296. To your best knowledge and belief you signed claim 31, didn't you in 1924? A. Well, I did sign the claim but I do not critically examine all the claims to see how they, I know the part that I submitted to the solicitor had nothing of that sort in it, it had only in it about the higher speed.

XQ298. I read you another extract from the specification: "For correct sound reproduction it

is important that the development of the positive and negative be so carried out that the transmission of the positive is at every point proportional to the exposure of the negative. This is in general not the best condition for the pictures as under these circumstances they will usually be too harsh. In the system here proposed the picture negative and positive can be developed to give the most pleasing results for pictures, and yet the negative of the sound rec- 1118
ord can be so developed that when it is printed on the picture positive film, the required contrast is obtained in the positive sound record."

Has that statement got anything to do with the additional speed of your positive? A. Well, I do not know just how that comes into the general context of it.

XQ299. Here is the patent. I think I read from page 3, the second column, starting at line 70, down to line 85. A. But in the next paragraph—let me see. Well, that does describe, if this method is used, that you can obtain these results. 1119
I may have—I haven't, of course, this application. When I sign the application, I do not strike anything out unless it is obviously wrong.

XQ301. Well, the statement that I just read to you there is a correct statement of fact, is it not? A. That is a correct statement—now, a correct statement of fact, that is a different question. It says, "Under the circumstances, the picture will usually be too harsh—"

That is on line 76: "This is in general not the best condition for the pictures as under these circumstances they will usually be too harsh." That would indicate that the contrast in the fig-

ures would be too high, in other words, that the pictures would have to be developed to a lower contrast. That I do not understand is correct. I understand that is not right.

XQ304. That is not correct today from the information that you now have, is that right? A. That is, from the information I have gathered from this testimony here anyway. As far as I knew it was correct as far as concerned the in-
1121 formation I had in 1924. I apparently was under that general impression, why, I do not know.

XQ306. I read you another statement from your specification, page 4 of the printed patent, line 5:

> "Due to variations in lighting conditions and in the character of the objects being photographed, motion picture negatives may vary greatly in density throughout the length of a single roll of film. It is customary to correct for this by varying
> 1122 the intensity of the light used for making positive records from the negatives. Sound records on negative films, on the other hand, may be produced under more easily controllable conditions, so that usually no such correction is required or desirable, or if required, the correction will be different from that of the corresponding portion of the picture record. In accordance with this invention a separate lighting means is used for the picture and sound records, respectively, during the printing."

Is that correct? A. That was correct, as of that date, to the best of my knowledge.

Edward C. Wente—For Defendant—Recalled—Re-direct. 1123

Mr. Ward: I offer in evidence as Plaintiff's Exhibit 28, the file wrapper of Dr. Wente's patent, which he has testified about. Also the references therein cited.

(File wrapper and references marked Plaintiff's Exhibits 28, 28-A, 28-B, etc.)

XQ307. Doctor, does the copy of the patent I show you correctly indicate in Fig. 3, the separate sound and picture records that you said 1124
you worked on in 1922 and 1923? A. Yes, I think it does.

Mr. Ward: I offer in evidence the patent shown the witness filed by T. J. Engel and assigned to Western Electric Company No. 1,654,926, issued January 3, 1928, on an application filed October 2, 1923.

The Witness: I have never seen this one before.

(Marked Plaintiff's Exhibit 29 in evidence.) 1125

Re-direct Examination by Mr. Ashton:

RDQ309. Will you state what you understand to be the advantages of using two films in reproducing, as compared with a single film, for example? A. In using two films in reproducing, it is possible to get improved sound quality because you can use a wider sound record, which means that the ratio of signal to ground noise is higher, and if you have a separate reproduction, your sound record is not subjected to the intermittent motion that the picture record is, and you thus

have less wear of the sound record, introducing less scratches and surface noise, and also the strain on the film is less, so that the film producers would possibly be capable of producing better film for sound purposes, and they might have film that might have less strength, but that could be sacrificed in the interests of film which would give less noise.

RDQ310. You testified regarding the use of
1127 such double film reproducing systems in the studios, I believe, at Hollywood. What are those two film reproducing machines used for in the motion picture studios? A. They are used in the theatres that the producers have where the pictures are taken and in which—for instance, they take pictures and record sound during the day, and then in the evening, they call them rushes, and they take them over to the theatre and they project the picture and the sound record there for general inspection to see whether the photography or sound recording or the general scenic
1128 effects are what they would want. Then, also, after they have approved the takes, they will afterwards project them again separately with those machines and do the editing in that manner.

RDQ312. Have you ascertained the approximate number of studios that these machines are used in? A. Well, some of these companies have several studios, but they are in the number of 25 actual studio theatres.

RDQ313. Mr. Ward asked you, Dr. Wente, whether you had seen any of Dr. Engl's publications, I believe, and you stated that you had recently seen some of them and as long ago as two years you had seen Dr. Engl's book. Do you

know what the width of the sound track was that was referred to at any time by Dr. Engl? A. From the picture of his—I mean from the reproduction in his publications of the picture and the sound track, if you scale that off, it is about 80 mills, eighty thousandths of an inch.

Mr. Ward: I object to that testimony as wholly immaterial and irrelevant.

The Witness: The article gives 2 millimeters in some of the other publications, 1130 but in this book, I am not sure, but I remember scaling it off, and that is about—it is 2 millimeters published somewhere, and that is in agreement with the—it is quite possible, however, to scale that off. It is a perfectly proper accurate way of doing it.

RDQ316. Will you state what you consider your particular contribution in the construction of the condenser microphone which was adopted for talking motion pictures? A. The principal 1131 element is the method of air damping that is applied to the diaphragm by a very close spacing of the back plate and the proper proportion, and in the microphone as it is developed at the present time Dr. Crandall made a thorough study of that phase of it and made some important contributions, and this air damping principle was applied subsequently to the high quality carbon microphones wherever that instrument was used and in place of the condenser microphone such as in some of the broadcasting studios.

1132 *Edward C. Wente—For Defendant—Recalled—Re-direct.*

Regarding the relation between the Research Department and the Apparatus Development Department of the Bell Laboratories. The two departments, the difference is mainly a functional difference. In the Research Department, the fundamental aspects of various problems are studied, and very often studies are carried out to see whether certain things may possibly have some commercial applications. But in the Ap-
1133 paratus Development Department, the subjects are studied more from the standpoint of the practical application and the design of apparatus in such a form that it can be manufactured and will be serviceable and reliable.

In this country the commercialization of sound pictures began I should say from the Vitaphone in August, 1926, because it is from that date that talking pictures have been shown uninterruptedly until the present time where practically all motion pictures are of the sound picture variety.

RDQ319. In your opinion, would sound pic-
1134 tures have been successful commercially without the developments to which you have referred of the Western Electric Company?

Mr. Ward: I object to that. I don't think the witness is capable of answering that.

Mr. Ashton: He is qualified as an expert.

The Court: We are going into a pretty broad field, are we not?

A. No, I think not, unless similar developments had been made somewhere else.

Edward C. Wente—For Defendant—Recalled—Re-cross. 1135

RDQ320. Had any such development been made at the time that the Western Electric system was introduced? A. No.

Re-cross Examination by Mr. Ward:

By the "Western Electric system" in the general discussion here, I meant the system that is supplied by the Western Electric Company to motion picture producers. That may be tons of steel and copper and what-not. The light valve 1136
for recording. That is one of them. Amplifiers, microphones. Of course, on the sound-on-disc system, those earlier developments—

RXQ325. Suppose we confine ourselves to this question to sound-on-film. A. The Fox Case system does use the Aeo light. In every other respect, it uses the same general system, I think, although at one time they did use their own machines for driving—not the motors or the interlock, but the particular mechanism through which the—the coil which controls the motion of the 1137
film.

The so-called Western Electric system uses a motion picture camera made by various manufacturers. Not by ourselves.

RXQ329. Uses a sound head attachment made by whom? A. Are you talking about recording?

RXQ331. I will have to change my question: Do you use separate machines? A. Separate machines for recording. We use in reproducing the photo-electric cell.

RXQ333. Your company does not hold a patent for the use of the photo-electric cell for use in reproducing, does it? A. I don't know wheth-

1138 *Edward C. Wente—For Defendant—Recalled—Re-cross.*

er they hold any patents or not. I know they have made very great improvements in the use of the photo-electric cell.

RXQ334. You know they don't hold a patent for the use of the photo-electric cell for sound reproducing, do you not? A. I don't know anything about the patents. I should not think they would hold a patent on a photo-electric cell for sound reproducing—I am sure they don't hold
1139 any patent on that.

RXQ336. Do you know that the District of Columbia Court has recently held that the Tri-Ergon Company, or the American Tri-Ergon Company—

A. I believe that is right. I have seen some of the opinion.

RXQ337. And outside of the light valve, and the loud speakers and microphones which are what I call supplemental apparatus, what is the characteristic, what are some of the other characteristics features of this so-called Western
1140 Electric System? A. Well, most of the characteristic features are embodied in these so-called supplemental devices, which you referred to.

RXQ339. You have given a few advantages of the use of separate sound and picture films. Now, perhaps you can tell us some disadvantages. Disadvantages of having two separate films for reproduction? A. Just for the reproducing, the single separate films as over against a composite. Of course, from the standpoint of quality, there is no disadvantage. The advantage lies in the fact that if you use one film it costs less than two films, and the space that is required in

the projection room is less because you can run it through one projector.

RXQ345. Separate film reproducing requires two machines instead of one, one for the pictures and one for the sound? A. Of course, when you have the common, you have to have—you might say you put the two machines in series, and when you have separate, you put the two machines in parallel—the cost is less where you have the single film. And, of course, the cost of the film itself is approximately one-half 1142
with the single film.

RXQ349. I take it, you agree with me that the idea of using a single film as a positive film for the sound and pictures, far outweighs the disadvantages? A. My personal opinion is that it does not.

RXQ350. Technically or practically? A. Practically, yes; I mean, practically, because I would rather have good sound quality than sacrifice that for practical gain.

I stated that the date from which the com- 1143
mercialization of sound pictures began in this country was when we put out the sound on disc system. In giving that statement, I do not overlook Dr. DeForest's demonstrations in this country in theatres, around 1923 and 1924, for a while, I am not overlooking Edison or Messer or a whole series of exhibitors in times past. As to the Deforest's, I don't know that they were commercially put out in theatres. I know that they were a novelty, and I heard one of them that I was sure, if the rest of them were like that, they would not stay very long, and just how

1144 *Edward C. Wente—For Defendant—Recalled—Re-cross.*

long the installations and pictures were shown I don't know. But I know they were not being shown in 1926. I should say they were tremendously worse than our disc record system when we first put it out in 1927.

Of course, I did not hear all the films that were exhibited, but the particular one that I heard, did not compare with it in any way.

RXQ356. How well is that sound on disc sys-
1145 tem of yours getting along today? A. Well, I think possibly that the finest sound production today is obtained from these discs. I mean commercially, I don't know whether they are actually being shown in the theatres, but they have been demonstrated, and they are being put into commercial production, as I understand it, by the producers.

RXQ358. Is it not a fact that they are being very rapidly and have for some time been rapidly replaced by the sound on film system? A. I think at one time that the sound on disc system
1146 was ahead of the film, and the film did gradually come ahead of the disc, but I think that it is not at all unlikely that the disc, as far as quality is concerned, has been able to hold its own. When the finest quality is desired, I believe the disc will be used.

You say I am correct in saying that when our disc system was first put out, it was by far the largest used system, because that was the system we first put out, and we pushed it. I don't know anything about that. How would I know whether we pushed it. It is not my field. It would be just hearsay.

RXQ360. It was the first one and it had been in extensive use? A. It went in extensive use, yes.

RXQ361. Then you came along with the sound on film system, and the fact is that the sound on disc system is giving way, and today you have relatively few of them out as contrasted to the number of sound on film system? A. I don't know. I think there are more sound on disc than sound on film, because there are a great many theatres that have sound on disc in 1148 use, and they have no facilities for sound on film. That is my information.

RXQ362. Why is it that the small theatres keep on using them and the big theatres do not to the same extent? A. As a guess from the commercial standpoint, the disc, I think, is probably cheaper.

Mr. Ashton: I would like to ask Mr. Ward if he will stipulate into the record the original claims of the Craig patent here relied on, namely No. 1,260,337, which 1149 was filed May 6, 1913.

Mr. Ward: I object, anything said about Craig in the Patent Office is wholly irrelevant and immaterial here; it can't be a part of a reference or a citation of anything.

Mr. Ashton: That is not true, your Honor.

The Court: The patent is in evidence.

Mr. Ashton: But the file history isn't, and yesterday Mr. Ward asked Mr. Jones to refer to the claims of the Craig patent,

and asked him whether they weren't all limited to this feature which he says Craig was most concerned about. This shows that Craig in 1913 claimed this composite film, which Mr. Ward is claiming is the invention here in suit, and that claim was rejected on the Haines patent, which was applied for in England in 1906.

Mr. Ward: In the first place, I disagree with Mr. Ashton's statement that what we claim is a composite film. In the second place, he knows I referred his expert, Mr. Jones, to those claims for the purpose, and only for the purpose of checking him up on his interpretation of that claim. I asked him where he got the basis for his contention that there was any such interpretation as he put on it, and those claims were read to him to show that they related to overlying, only. Mr. Jones had expressed an interpretation of the Craig patent which was different than that, and he expressed it from the patent that he had.

Mr. Ashton: I think we are entitled to it in view of his cross examination.

Mr. Ward: That was not available to the witness, should not have been available to the witness, he should have based his interpretation solely upon the patent which was in evidence, and my question was based on an interpretation of that patent put in evidence.

Mr. Ashton: It has a direct bearing. I would like to make this very clear: The

1153

Patent Office expressed doubt during the appeal from Claim 1 in the interference in this case, as to any invention being involved in this subject matter, but allowed the claim in view of the existence of the DeForest patent, the interfering patent.

Now, the file history of this prosecution shows that it was because of this patent, Here the Patent Office back in 1913 had rejected this claim for a composite print, having in mind Craig's separate recording, 1154
his separate developing and his printing on the same film.

Mr. Ward: I do not see that it has anything to do with it, that what Mr. Ashton has said, has any relevancy to the situation.

The Court: Mr. Ashton asked you to concede something. It isn't before me. It is argument between counsel.

Mr. Ward: No, he is trying to offer it in evidence, and I will not stipulate anything about it. It is so irrelevant and im- 1155
material. I object to this thing being put in evidence.

The Court: You offer it in evidence now?

Mr. Ashton: Yes.

The Court: I will take it and look at it; I do not know what there is about it. If it isn't material, I will not consider it, if it is, I will.

Mr. Ward: May I have an exception?

The Court: Certainly.

(Marked Defendant's Exhibit Q in evidence.)

1156 *Lloyd A. Jones—For Defendant—Recalled—Cross.*

Mr. Ashton: The reference referred to in the file history is the Haines patent; it is attached to it. I offer that.

(Marked Defendant's Exhibit Q-1 in evidence.)

LLOYD A. JONES, recalled.

1157 *Direct Examination by Mr. Ashton:*

I will read a question which I wish to correct. On page 433 of the record, XQ599: "Then in Defendant's process, to cure the difficulty arising from using different lighting conditions in photographing the picture and sound negatives, the defendant uses different film stock for the sound and picture negatives and separate development treatments: is that right?" I quite misunderstood the import of that question which implies
1158 that the positive and negative stock, or rather the positive stock is used on account of a lighting condition of recording. That is not the case. The positive stock is used on account of its characteristics of fine grain, high resolution for the better rendition of the sound record.

Cross Examination by Mr. Ward:

XQ860. Now, Mr. Jones, when I put that question to you yesterday, you recall taking your time about answering it, don't you? A. No, frankly, I do not, I do not remember all the details.

Lloyd A. Jones—For Defendant—Recalled—Cross. 1159

XQ861. Tell me who called your attention to this question since you left the stand. A. I noted it in reading over the testimony myself.

XQ862. What do you find wrong with your answer yesterday on account of the question exactly? A. That answer would imply that I agree with the implication in the question that the positive stock is used as a result of the lighting conditions existing in recording.

XQ864. Is your interpretation, interference, in 1160
that, comparable with the inference you drew from the quoted clause in the Craig patent? A. Well, I do not remember that quoted clause.

XQ865. Well, will you read that question and see if you find in it any statement that the sound positive stock was selected on account of lighting conditions? Doesn't the question state on account of lighting conditions the defendant uses different film stock for sound and picture negatives? A. Yes, on account of lighting conditions.

XQ866. Might not that be the selection of the negative stock on account of the lighting condi- 1161
tions, yes or no? A. I do not understand the import or what the meaning of that is. To me the question definitely implies that the positive stock is used because of the lighting conditions in making the sound record. Now, that is not the case.

XQ867. Nobody has said it was. A. That is the thing I wanted to correct.

XQ868. Nobody ever said it was. Didn't you testify that the positive stock was used because of its fine grain, but that the positive stock was not suitable for the negative picture record on

account of its slowness, and that it would be over—or under-exposed if it was used for that purpose? Do you remember giving that testimony? A. I testified to that, and I also at the same time said that there were other considerations which would make positive stock unsuitable for recording pictures.

XQ869. All right, then. If the negative stock is used because of lighting conditions and the
1163 positive stock is used for any condition or reason you see fit to give it, this question and answer of yours are correct, are they not? A. Well, in the first place, the wording "difficulties arising from the use of different lighting conditions," if there were any difficulties arising from a difference in the lighting conditions, for instance, if we had too much light in recording the positive, the sound record on positive, or on the negative film or on any film, it would be very simple to cure that difficulty by using a lamp of lower intensity. You do not have to use dif-
1164 ferent film to cure that difficulty.

XQ870. Do you want to correct your answers to the few previous questions to have them jibe up with the correction of the one you wanted to correct? Look at XQ595; do you want to change that one? If you do not want to change that, why do you want to change XQ599? A. As far as I can see, the answers to the questions you have mentioned are correct, while the answer to this question is not correct and it is not in accordance with the things I have previously stated about why positive and negative films are used.

XQ871. Do you find any statement in my question XQ599 that the positive stock is selected on

account of lighting conditions rather than the negative stock may have been selected because of lack of lighting conditions under defendant's system as testified to in XQ595? A. I can only say this: I feel that the answer to the question 599 which I gave yesterday was incorrect, and I wanted to correct it.

Mr. Ashton: I wish to state also for the purpose of the record that the Tri-Ergon 1166
application for photo-electric cell referred to by Mr. Ward as the subject matter of an opinion in the District of Columbia has not yet issued, but is in interference.

Mr. Ward: I said that in my opening.

Mr. Ashton: The defendants rests, your Honor.

WILLIAM C. BALLARD, JR., recalled in rebuttal, testified as follows: 1167

Direct Examination by Mr. Ward:

Q298. Professor Ballard, will you take the Greensfelder patent No. 1,254,684, set up by the defendant and explain it to the Court, or such parts of it as you think are necessary to have him understand it? A. This Greensfelder patent was issued for a method and apparatus for synchronously producing sounds to accompany motion pictures.

The specifications beginning at line 10, page 1, state: "The present invention relates to an im-

proved method of producing different sounds during the projection of motion pictures upon the object screen."

At line 21: "Unusual sounds, such as the report of a gun, the shriek of a whistle, the clatter of horses' feet, the cry of a child, the ringing of a bell, etc., all of which add greatly to the vividness of the scene, are generally assigned to one of the men in the orchestra to be reproduced as
1169 nearly in synchronism with the corresponding action in the picture as possible.

"The object of the present invention is to provide an improved method whereby these various supplemental sounds, or even the piano accompaniment will be produced by the various instruments in exact synchronism with the reproduction on the picture screen of the scene of which they are illustrative.

"The invention consists in providing a system of control for these several instruments which will be automatically operated by the picture film
1170 itself."

Skipping down to line 50: "The lines may each represent one note of a piano (in the case of a piano record), while others may represent an expression lever, a sustaining pedal, or the operating mechanisms, or instrumentalities for beating a drum, ringing a bell, blowing a whistle or producing like noises. The light from the motion picture machine passes through these transparent 'sound marks' as the film is being shown on the screen. These light rays are intercepted between the lens of the machine and the screen, or at the screen, and caused to fall upon a series of exposed, separate selenium cells. An individ-

ual selenium cell is provided for each 'sound mark' of the film and each ray of light is directed by a system of slots and guides to exactly register with its corresponding cell. These cells are in turn each connected with a separate relay, electric battery and electro-magnet, the latter being so placed as to mechanically operate the sound instrumentality upon its becoming energized."

Then, after a general discussion of some of the 1172
principles involved, I skip to page 2, beginning at line 90: "Each particular 'sound mark' 3 on the film has a corresponding selenium cell 11 on the shelf 9, upon which it is adapted to impinge a ray of light as it passes between the light source and the lens of the projecting machine. When, for example, it is desired to apply the invention for the purpose of operating a player piano 88 'sound marks' 3 are provided, one for each note of the piano and additional 'sound marks' for expression levers."

The method of photographing these sound 1173
marks is next explained in detail, and skipping to page 3, beginning line 52:

> "By way of illustration, Figs. 7 and 8 show the manner of photographing the 'sound marks' to record the notes of music played upon a piano. Each key 17 or expression pedal 18 of a piano 20, or other instrument the sound of which is to be recorded, operates a hammer 21, or corresponding part of another instrument, and at the same time moves a rod 22, which in this case is moved vertically. At the upper

end of the rod 22 a plate 23 is carried, provided with blind or shutter part 24 and a corresponding opening 25 located immediately below the same. The plate 23 is adapted to normally remain in its lowered position with the shutter 24 intercepting the rays of light from any suitable source L, and preventing them from registering with an aperture 26 formed in a horizontal shelf 27."

Skipping to line 92, the same page:

"In order to secure the best results it has been found advisable to have a motion picture positive properly pieced and joined so as to be ready for projecting and exhibiting before recording on the film in camera 28 the rows of 'sound marks' that are to accompany the animated picture. This positive should contain on it blank spaces in the position of 3, Fig. 1."

I might state here that that is an obvious error, that it should be Fig. 3.

Q288a. That is in every day parlance, what he is referring to there is the idea of first simply taking a picture of the scene and developing that negative of that picture without any reference to sound, and then taking the positive of it and projecting it, and then he proposes, as that positive is projected on a screen to have some person or persons make some noises, or musical instruments, which he proposes to register or record, is that right? A. That is correct. These

noises are recorded on the film by opening various blinds or shutters referred to as part 24, and allowing light from some other source to fall through the lens of the recording camera.

Q299. And is the apparatus for letting that light fall onto the film shown in Fig. 7? A. It is.

Q300. And we had some discussion yesterday during Dr. Jones' testimony about what that light passed through. Are the openings that the light rays pass through shown in Fig. 8, the 1178
openings being 25 of the bars 23? A. Yes. When the opening 25 is raised so that it coincides with the opening 26, then the light may pass through and register on the film.

For illustrative purposes in the drawing, that opening, the two openings are in register at 26 in the middle of Fig. 8:

> "On the completed positive ready for the market these blank spaces will be filled in by rows of sound marks and the spaces for the pictures by the pictures, which can be effected by such a method as print- 1179
> ing the positive from the two superimposed negatives, as will be hereinafter described. The pianist or musician, who is to play the accompaniment to be recorded for the picture, watches the positive picture as it is projected on the screen before him from a motion picture apparatus at a definite speed. After he has become familiar with the picture, the positive is again projected through the motion picture apparatus and he then plays the accompaniment to the picture, introducing

1180 *William C. Ballard, Jr.—For Plaintiff—Rebuttal—Direct.*

whatever melodies, chords, compositions or sound effects he thinks appropriate to the action of the objects or characters in the picture."

The description so far is devoted to the general principles of operation of this patent, and there are several different types of record which may be produced by the apparatus shown. On
1181 page 4, beginning line 9, the picture player type or perforated record, the counterpart of that type of record, rather, is described. That is the second suggested process now that I am coming to.

Q304. Will you point out where in the patent a record is shown according to his first suggested process? A. According to the first, the record according to the first suggested process is indicated in Fig. 3. And the sound marks are arranged in a horizontal row alternating between the successive picture records or picture frames.
1182 In further describing the picture player type of record, he says, "Another method by which these rows of 'sound marks' 3 may be recorded so as to appear as shown in Fig. 3, is by making a marked or perforated roll of the music and sounds, such as is used in player pianos, and automatic musical instruments. This roll is then moved in the direction of its length at the proper speed and is photographed through a slit by a motion picture camera, on the film of which the spaces for the pictures are not exposed to the light."

This is the record, this still refers to the type of record exhibited in Fig. 3.

The patentee further describes a method of producing a continuous record on which these sound marks are shown as illustrated in Fig. 4, beginning page 5, line 13— I am not coming to the third suggested method.

Q309. The second one that you described just now, as I understand it, was the idea of putting the horizontal rows of sound marks alternating with pictures by means of using a perforated music roll for the recording of the sound marks, 1184 rather than shunting the light through the bars attached to the piano, is that right? A. That is my understanding.

Beginning now, page 5, line 13:

> "The method in which the 'sound marks' are photographed on a separate film adapted to be continuously driven and geared to the sprocket turning the picture film will next be described. As shown in Fig. 4, a separate film 29 is used for the 'sound marks' and instead of having them formed in rows between the pictures, as 1185 described in connection with Figs. 1 to 3, the marks for each note, expression element or sound instrument are continuous."

Then, skipping down to line 32 on the same page:

> "This sound film 29 can be photographed from an operating piano or mechanism."

Skipping to line 42, on the same page:

> "As described in connection with the method illustrated in Figs. 1 to 3 and 7

1186 *William C. Ballard, Jr.—For Plaintiff—Rebuttal—Direct.*

> and 8, this film may be made by first making a perforated roll of the sound accompaniment such as is used for player pianos and then while this roll is moving in the direction of its length and at the proper speed, photographing it through a slit by a motion picture camera from which the shutter and intermittent sprocket mechanism have been removed."

1187 These last two quotations show two different methods of making the piano player type or sound marks as shown at the right hand side of Fig. 4.

A fourth method in reference to Figs. 5 and 6 is described, beginning at line 108, page 5:

> "Referring to Figs. 5 and 6, the invention is shown as applied to a film of double width, one-half of which contains the pictures 38 while the other half contains the 'sound marks' 3^2 formed similarly to those
1188 illustrated and described in connection with Fig. 4."

Skipping to line 128, the same page:

> "A convenient way to obtain the film 40 is to first photograph a negative of the original sound film and place it side by side with a finished and pieced negative of the corresponding picture film, then, from the two print a one piece double width positive, such as shown in Fig. 5."

Fig. 5 is referred to in this last statement.

1189

Q314. And what is the character of the sound record—by "sound record" I mean the sound record that he talks about—that is shown there in Fig. 5? A. It is a continuous type of record as compared to the intermittent type of record illustrated in Fig. 3.

As shown in Fig. 5, the sound record is a negative record. The picture record is a positive record.

Q317. Where do you get that from? A. The description of the manufacture of this record is 1190
quite clear and is described, beginning line 128, page 5:

> "A convenient way to obtain the film 40 is to first photograph a negative of the original sound film and place it side by side with a finished and pieced negative of the corresponding picture film, then from the two print a one piece double width positive, such as shown in Fig. 5."

I think it is an obvious matter that when a 1191
negative is made of a negative, a positive is produced, and by printing from a positive to form the final object, a negative record is produced for the sound marks and a positive record for the picture sequence, as illustrated in Fig. 5.

This is further borne out by the fact that the operation of the apparatus in Fig. 1 requires the light to be eliminated from the selenium cell on shelf 9 before the magnet 16 is energized and the piano note struck—

Q318. Fig. 1 illustrates the system for reproducing the sound under this proposed system, is

1192 that right? A. Reproducing the sound from these marks. As I stated before, when the light is interrupted on the selenium cell 11 located on the shelf 9 of Fig. 1, the relay 14 drops the armature and closes the contact, allowing the battery 15 to energize the magnet 16 and depress the key 17, striking the note on the piano or beating the bass drum or causing the shriek of the child or action of a whistle, or whatever happens to be
1193 connected with this mechanism.

Q320. Now, what condition of the film is necessary to shut off the light, in other words, does the shutting off of the light from that selenium cell require a transparent opening or section or an opaque section? A. It requires a corresponding opaque section on the film.

Q321. So that according to this figure 1, in addition to the description you have read, it is an opaque mark which would shut off the light from the selenium cell and cause the piano key to be struck? A. That is true. And I may add that
1194 the patentee has described the method in detail of producing such a record as would satisfy this condition.

Q322. Would you say that in your opinion the method of producing the picture record and sound mark record of this patent is the same or different from that of the patent in suit and the defendant's? A. It is different from both the patent in suit and that of the defendant.

Q323. Did you hear Mr. Jones' testimony here at page 320 with reference to forced developing, I believe he called it, causing an undue spread of the image of these sound marks of Greensfelder? I hand you that testimony. You will find it in

Q186, answer to Q186 and 187 and 188. (Handing to witness.) A. I did. I do not agree with him. I have seen many thousands of feet of film produced by the single film process in which both picture and sound negative records were made on a single film and printed onto a single positive film, and in which the sound record—the true sound record on this type of film consists of a succession of fine lines, and in no case were there any indications that these fine lines were 1196 unduly spread by the proper development accorded to the picture sequence.

Q326. And these fine lines were finer or coarser than the proposed Greensfelder lines? A. In many cases, much finer than those proposed by Greensfelder.

Q327. What have you got to say with respect to the width of a slit through which light may be projected to operate a selenium cell? A. The width of the illuminated area of the film in most systems of sound reproduction today—and I think this is true in the case of the Western Elec- 1197 tric system—has an effective width of approximately one-one thousandth of an inch, and it is obvious that the light to operate the sound-translating mechanism must pass through this restricted area. If the selenium cell were used, as I understand it has been used, I have seen them in operation, the light would, of course, have to come through this restricted area.

Q328. Then, with regard to the present sound recording practice, it is the width of this slit as photographed that determines the width of the line on the film, I mean the width of the beam of light which will show on the selenium cell, is

1198 that right? A. It shows that a line at least as fine as 1/1000 of an inch might be used for reproduction.

Q329. Then, the testimony Mr. Jones gave when he was recalled to the stand yesterday afternoon that the number of lines per unit of length, I think it was an inch, was about 250 rather than 1,000, is not the controlling factor here, is it? A. I think his testimony was correct,
1199 but that it did not apply to the case which you had in mind.

Q330. I say, it was not the controlling factor? A. It was not the controlling factor because a line several thousandths of an inch in width, of course, cannot possibly be completely behind the opening at any one instant of time.

Q331. Then, we get back to the point that the minimum width necessary or the width necessary could be about 1/1000 of an inch for the opening? A. I should think that is a fair statement.

Q332. And that contrasts with the Greens-
1200 felder situation of 88 lines across the film? A. That is true. That would allow approximately a space of 12/1000 of an inch for each note on the piano.

Q333. That is, in Greensfelder he would have a space of 12/1000 for each note on the piano? A. Yes, that is approximately true.

Q334. Now, what would the degree of spread for forced development have to be to have those lines interfere with each other? A. They would have to be increased in width by at least twelve times.

Q335. Did you ever hear of any photographic process where the width of a line merely by

forced developing would be increased or had been increased twelve times its original width? A. I know of no such process.

Q336. What would be the result of the pictures on any film in which that took place? A. They would be hardly acceptable.

Q337. I refer you to Fig. 12 of the Greensfelder patent, and ask you what that shows and whether that has any bearing on this point? A. Fig. 12 is referred to in line 85, page 2, and is 1202 described as: "A slotted screen or grating 12 may be properly positioned in front of the shelf 9 for the purpose of reducing the magnified light rays coming from the 'sound marks' and preventing overlapping of the rays on the selenium surfaces".

It can be seen from reference to this drawing that the space between the openings is at least as large, if not larger than the space occupied by the openings themselves. This would effectively prevent the effect of the spreading of the sound marks due to undue forced development. 1203

Q338. Then, in your opinion, there is nothing to Mr. Jones' theory or statements about the spreading of these sound marks making it advisable to separately develop the Greensfelder picture record and sound record? A. That is true.

Q339. Do you find any reason for separately developing the Greensfelder sound marks and picture records, so far as concerns the character of the result in the pictures or the sound marks? A. I find no such reason.

Q340. In Greensfelder the sound marks are not made simultaneously with the picture, but

as I understand it, the picture film is first made and developed and then the sound marks are recorded or scored during a projection of the picture from the already made positive picture film, is that right? A. That is the case as described in the patent specification.

Q341. And it is because of that fact, that they are developed separately because one must be made ahead of the other? A. Yes.

1205 Q342. Does the Greensfelder patent teach anything at all with regard to the recording of acoustic vibrations? A. It does not.

Q343. I refer you to the Bullis patent and will ask you if you will explain to the Court what is disclosed in that patent? A. This patent, Bullis No. 1,335,651, discloses a method for producing talking picture apparatus in which the sound and picture are recorded separately on two separate lengths of films, given the necessary development process, and from these two individual lengths of negative record, two corre-

1206 sponding individual lengths of positive record are produced. These two positive films then may be reproduced in the manner shown in Fig. 9, either cemented together or allowed to remain entirely separate.

Bullis shows a special feature to enable subsequent matching of the films, in order to obtain synchronism in reproduction and obtains a series of corresponding marks by using a third film at the time in which the sound and picture are recorded. The third film overlaps the edges of the other unexposed films, and passing before an opening, exposes the edges of these two films

and prints on them corresponding numbers for the purpose mentioned previously.

Q344. Does Bullis show or teach the printing of the picture record and the sound record on the same positive film? A. Nowheres in the patent is any suggestion of this process given. In fact, Bullis very definitely describes what he considers as the impossibility of doing this action. I refer now to line 28, page 1:

> "Further objects of the invention are 1208
> to provide a device of this character which is comparatively simple and inexpensive in its construction, which admits of different emulsions and different treatments, being employed in making the picture record and sound record, which provides corresponding identification marks upon the picture record and sound record so that there will be no difficulty in assembling the two records in the proper relation for the reproducing operation." 1209

It is evident that in this citation, the two "records" refer to the positive sound and picture film.

Again, on page 4, beginning line 37:

> "The corresponding identification characters 10^a and 11^a on the respective films indicate corresponding portions of the picture record and sound record, so that there is no difficulty in arranging the films for a synchronous reproduction of the pictures and sounds."

Here again the term "picture record" and "sound record" refer unmistakably to the positive films.

Line 78, page 4, states:

> "The sound record employed for reproducing purposes is made by contact printing from the master sound record film, and it will accordingly be obvious that in
1211 the reproducing sound record the loud sounds are represented by light or partially transparent," and so forth.

It is clear in this connection that the word "record" refers definitely to the positive film.

On line 94:

> "the two records have been completed by the special individual handling or treatment necessary to the best results for each record, they can be readily assembled in
1212 the proper relation to produce a synchronous reproduction of the pictures and sounds."

The use of the term "record" in this case definitely refers to the positive film.

When Bullis describes the process through which these records are to be put, he says, beginning page 2, line 1:

> "Where the two records are made upon the same film, using the same emulsion, it must be obvious that a proper treatment or development of one record can only be

obtained at the sacrifice of the other record, since the special form of development required to get the best results from the two records would ordinarily be quite different. It will thus be seen that there are very important practical reasons why the two records cannot be successfully and satisfactorily made upon the same film, as has been previously proposed, and it is the object of the present invention to over- 1214
come this particular objection, by providing a construction which admits of the records being made upon different films, which may have different emulsions and may be individually treated in the development exactly as may be required to produce the best results. These two independent films have corresponding identification marks made upon the same at the time the records are made, so that they can be assembled without difficulty in the proper manner necessary for a synchro- 1215
nous reproduction of the pictures and sounds."

From what has gone before, it is quite obvious that Bullis is referring to both positive and negative records.

Q345. Do the claims shed any light on that subject? A. Claim 1 at line 110 refers to the "two records to facilitate assembly for a synchronous reproduction".

Claim 2 speaks of "a series of corresponding identification marks upon the films to facilitate assembly for a synchronous reproduction".

1216 *William C. Ballard, Jr.—For Plaintiff—Rebuttal—Direct.*

Claim 3 contains the statement: "to facilitate assembly for a synchronous reproduction".

Claim 4 refers to the negative record only.

Claim 5 refers to negative records only. The same is true of claim 6. The same of claim 7—

Q346. I think that will be enough to illustrate the purpose. I refer you to page 4 of the Bullis specification, the statement commencing in line 57, and ask you to read that statement and state
1217 what you understand by it. A. "The picture film 10 and sound film 11 may either be kept separate and distinct from each other, or the overlapping edges thereof may be cemented together so as to produce in effect a single film".

Q346a. Do you understand that to mean that the sound and picture records are to be printed on the same film? A. It clearly does not state that, and points away from that idea by the words "in effect a single film".

Q347. Can you state what the disadvantages of the Bullis system are? A. In the production
1218 of positive films the usual practice is to supply the exhibitor with lengths of approximately 1000 feet or similar values. It is well known in the art that motion picture films shrink and expand, due to different treatments, one of which is the amount of moisture which may be contained in the film, ageing of green film, and other effects. If it were attempted to glue two one-thousand feet lengths together, unless the film were of exactly the same characteristic, which would be extremely difficult, if not impossible, to obtain, it would not be very long before the corresponding perforations would be out of line with one an-

other and the film would mount the sprocket and become damaged.

From a practical standpoint, there would be considerable commercial difficulty in scraping off the emulsion from one film and cementing these two lengths together, which would add greatly to the cost.

If one film should expand or contract more than the other, there would be a tendency for buckling of the film. 1220

A combined film would obviously require cans for shipment of approximately twice the size of a single film for a given length of picture film; and particularly in the case where such a film is spliced, a very difficult situation would be encountered, because at the position of the splice, there would be a thickness of four films glued on top of one another, which may have some effect on the film jumping the sprocket in the apparatus or other similar characteristics.

Q348. Referring to the bulkiness and the size of the cases, you mean that if a film would be 1221 cemented together, you get double the thickness of the film, which means that when you forward it in reel form, you have twice the diameter of the container? A. That is true, as well as twice the thickness of the container. And that also applies to the increased bulk in the picture machines.

Q350. What would you say as to the relative cost of handling positive film in that manner, as contrasted to the situation where we have the sound and pictures on one piece of stock? A. Without having any definite figures in the mat-

ter, I should think that the cost of a film produced in this manner would be at least twice the figure, if not more, of the cost of production of similar lengths of positive film in the usual manner.

Q351. The applicants of the patent in suit propose as one of their alternative procedures to cement the negative picture and sound records together and then print from those onto the
1223 same positive film. Is there any difference in that situation than in the Bullis situation that you have been discussing here with respect to disadvantages? A. There is a very considerable difference. When pictures are taken they are usually taken in comparatively short lengths, known as shots, which may be from a few feet up to a few 100 feet in length, and the difficulties in lack of spacing of sprocket holes increases directly as the length of the film. It is a cumulative variation and would be much more diffi-
1224 cult in the case of the Bullis patent than it would in the case of cementing the two negatives together.

Q352. In addition to the differences in length, what have you got to say with respect to the differences in costs in the two cases? A. For each negative film, many positive films are produced. As many as several hundred prints may be made of single negative film. This operation would have to be gone through once for negative film and perhaps several hundred times for corresponding positive films.

Q353. Mr. Jones pointed out some advantages of giving up the full width of one of the films

to sound records. Do you agree with his testimony on this point? A. Whereas some of the very earliest sound records were made entirely across the width of standard motion picture film, these records were made with wide slits. Today, the usual practice is to have a slit width of approximately 1/1000 of an inch, or an effective slit width in case the so-called optical slit is used. This would mean that in order to produce frequencies in the upper range of sound, 1226
it would be necessary to have this width absolutely at right angles with the direction of motion of the film. If one end of the slit were 1/1000 of an inch higher than the other end of the slit, an extremely serious loss of high frequency tones would be encountered.

This is not difficult if the length of the slit is 100 mils, because this means then that the tilt of the slit for a variation of 1/1000 of an inch would be one per cent. If the full width of the film of one inch were used, this would represent a tilting of the slit of one tenth of one per cent, 1227
and it is extremely difficult to keep a 1/1000 width slit lined up all the way across the film.

Mr. Jones was undoubtedly correct in his statement with regard to the averaging of slight variations in film structure, but this average becomes constant after the length of the slit has attained a certain value, and this averaging action has been shown by test to vary inappreciably from a slit length of 100 mils to 250 mils; that approximately the same ratio of background noise to sound is obtained on a slit length of 100 mils as would be on a quarter inch length.

1228 *Courtland Smith—For Plaintiff—Rebuttal—Direct.*

COURTLAND SMITH, called as a witness in behalf of the plaintiff being first duly sworn, was examined and testified as follows:

Direct Examination by Mr. Ward:

Courtland Smith; 48 years old; 255 East 71st Street, New York City; President of Pathe News.

In 1926, I was familiar with sound and picture
1229 development in the Fox Case studio work, and with the commercial work of the Fox Case Company for a few years thereafter. I had charge of that work.

The beginning of sound, so far as William Fox was concerned occurred about February, 1926. I entered Mr. William Fox' employ on the 1st day of January, 1926, and shortly thereafter, possibly a week or ten days, I had discussed with him the question of sound in pictures.

Previous to that time, four years previously, while I was in the Hays organization, I had fol-
1230 lowed the development of sound in relation to motion pictures, both on films and on disc; and when I went with Mr. Fox, one of the things I had in mind doing was to help him to develop this what I considered coming art, sound pictures.

Mr. Joy, whom I had known all my business life, and who had been with me in the Hays office, following all scientific developments in relation to motion pictures, had been in touch with Mr. Case of Auburn, New York, and had told me in the few years previous to 1926 that in his opinion Case was further along in the development of sound on film than anyone else.

1231

Almost immediately after entering Mr. Fox' employ, I arranged to take Mr. Joy over to Mr. William Fox. And in the very late winter or very early spring of 1926, Mr. Joy told me that it was time either to go to Auburn, and see the Case development, or arrange in some way to bring it to New York.

We actually did bring Mr. Case's equipment to New York, either the very end of April or the very beginning of May, 1926. We arranged the 1232
reproduction apparatus in what was known as Parlor B on 10th Avenue and 55th Street, New York City. We then took it into a theatre, the Nemo Theatre, Broadway and 110th Street. The results of all this, while in a way crude, were more than satisfactory to us, as pointing to a possible important development in the motion picture business.

Mr. Fox, having heard the crude film that Case brought down from Auburn and one or two short subjects that we made at Tenth Avenue and 55th Street, negotiated with Mr. Case, and 1233
sometime in July, he actually purchased the controlling interest in all of Case's patents.

During these negotiations, Mr. Case had referred from time to time to DeForest. Everyone knew, of course, that DeForest had been working for some time on sound-on-film, and in several of those talks with Mr. Case, he had referred to DeForest's trips to Europe, principally to Germany. That fact and the fact that Mr. Joy in his investigations had told me that in his opinion there had been a big development of sound-on-film in Germany, possibly antedating anything along those lines in any other country, made me

believe that the seat of the development which we were very anxious to find or the first source of this development might lie in Germany.

About that time I received a letter addressed to Mr. William Fox from Mr. Schroeder referring to some German patents. I had never known Mr. Schroeder, nor had ever heard of him, but immediately upon receiving the letter, I communicated with him, and the result was that I
1235 sent Mr. Joy to Germany, where he negotiated for an option on what was known as the Tri-Ergon patents.

I believe Mr. Joy left New York for Germany either the end of July or the first of August, 1926. By the time Mr. Joy returned, which was the latter part of the autumn or winter of 1927, we had progressed quite far with what was then known as the Fox Case Company. Mr. Fox had rented from the Fox Film Corporation an annex building on Tenth Avenue and 54th Street, the main building being on Tenth Avenue and
1236 55th Street, and in that building on Tenth Avenue and 54th Street, we erected the first sound studios possibly that were ever built.

We were then negotiating—that was the fall of 1926—with the Western Electric Company for a license. They had the best microphones and these were necessary in our work, and they were far advanced on sound-on-disc. They had given a public performance through the Vitaphone Corporation in August, 1926, which attracted a great deal of attention to sound in connection with pictures.

Now, I don't know how long to make this story because there are thousands of facts developed—

Courtland Smith—For Plaintiff—Rebuttal—Direct. 1237

As to the signing of this contract, the Fox Case Company with Western Electric— The contract was actually signed, I think it was the 2nd or 3rd of January, 1927. The contract was agreed to at the end of December, 1926.

As to the relations of the Western Electric and the Fox Case people in 1926. They were very close and friendly. They helped us and we helped them. We had one serious point of difference: They were sound-on-disc and we be- 1238
lieved in sound-on-film. In fact, before the contract was signed, it looked as if we could not agree to it for that one reason. Their contract at that time provided that they must select the kind of sound, the type of sound, the type of apparatus, and so forth. They had no confidence at the time in sound-on-film. We had no confidence at that time in sound-on-disc. They were entirely, except for some experimental work done in the Bell Laboratories, they were entirely sound-on-disc. We were at that time and always had been and to this day are, although I am not 1239
speaking now for the Fox Company because I have no connection with them, sound-on-film up to the time I left the Fox Company.

They did not insist on the Fox Company's use of sound-on-disc in that contract. We never were on sound-on-disc, but they insisted on the right, if they were not satisfied with the work that we did or the results, they insisted on the right to change it from sound-on-film to sound-on-disc. Off the record they said that they would give us every help and encourage us in our developments of sound-on-film, and that they did. They never insisted that we change from sound-on-film to sound-on-disc.

1240 As to what was the requirement, if any, that we should change from sound-on-film to sound-on-disc, their opinion that we would be better off and they would be better off to have us on the disc. They did not at that time have any confidence in sound-on-film. Their own experiments and developments had not gone very far, nor in my opinion were they very satisfactory at that time in sound-on-film. That development of theirs
1241 came later.

The contract provided that if they were not satisfied with the quality of sound-on-film that we got, that we would then have to go over to sound-on-disc, I remember all this very distinctly because Mr. Fox was very loath to sign the contract that gave them the exclusive right to determine whether we should be sound-on-film or sound-on-disc, but we had a good deal of confidence in the Western Electric, we knew very well their men, particularly their men in charge, and they assured us that they would not exercise
1242 that right, that almost autocratic right, unless we made a complete failure of sound-on-film. We had enough confidence in them, and I think it was thoroughly justified, to take their word that they would not make us change from sound-on-film to sound-on-disc unless we failed in the development of sound-on-film. We believed at that time that sound-on-film, although at that time it had not been publicly shown in a satisfactory manner nor had it been publicly shown by any Fox interest at that time, but we believed it was even then superior to sound-on-disc.

As to whether during this period around the latter part of 1926 or in 1927, the Western Elec-

tric Company submitted any sound-on-disc pictures for comparison with our sound-on-film pictures. It would be very difficult for me to answer exactly when they did that. Our first equipment for reproduction both in 55th Street and in 54th Street did not provide for reproducing disc. We later, possibly in the spring of 1927, equipped the 54th Street projection rooms to reproduce disc, but the reproduction of disc was being constantly done in the Warner theatres on Broad- 1244
way, so there was no difficulty in getting a comparison.

I got a comparison between the Fox Case sound-on-film and the Western Electric sound-on-disc at that time through that method of going to the theatres where the disc was being shown and then reproducing other pictures, not the same, because at that time there were no pictures that were recorded both on the disc and on the film.

In my opinion, there never was a time after the early fall of 1926, when sound-on-film was 1245
not infinitely better than sound-on-disc.

I was daily and nightly witnessing and listening to the reproductions of sound-on-film and I witnessed every public demonstration—not every one, that is incorrect, but every new one that came out, of sound-on-disc.

Often the Western Electric engineers and representatives were with me when I was doing this, and often they were not. I can name some of their engineers or representatives. The Western Electric's chief representative was Mr. John Otterson, who was in charge of their development for the Western Electric, as I was for Mr.

Fox. His assistant was Mr. Drake. Among their engineers were two men whom we later took over, excellent men: Whiting and Davee, and also there was a Dr. Crandall, who died shortly thereafter, and, oh, a number of engineers, some of whom I have lost tract of completely.

I met Dr. MacKenzie in connection with that work. Mr. MacKenzie, as we knew him, was particularly interested in the Western Electric at-
1247 tempts on sound-on-film, and I believe he had charge of that work for them. He worked constantly in our laboratories and studio in 54th Street for a period of at least six months. That was from the—I believe he came in even before the contract was signed, as some of their engineers did, and worked, oh, until probably the late spring or summer of 1927. We gave him every facility in the world, and I remember they used hundreds of thousands of feet of film in their own work in sound-on-film in those studios of ours. They did this work of sound-on-film in
1248 our studio shortly before the contract was signed. I believe their engineers came in about December, 1926, and they stayed there for a long, long time, it might have been a year; it might not have been more than six months; it was not less than six months. We were all working very hard to develop sound in connection with pictures, and while their particular interest was sound-on-disc, which we were not equipped to help them in, and in which they had far more knowledge than anyone else, it may have been that all of the work at that time that was being done on sound-on-film was done in those Fox studios. Nobody else was doing a single solitary thing in this country.

Q22. Some testimony has been given here in regard to the fact that Western Electric interests set up a light valve for recording sound in the Fox studios? A. Well, that was another point of difference. They had a light valve and we used a glow light. Their light valve was not a practical matter at that time. For instance, they couldn't photograph with it, they had no camera equipment for it. They could not take a picture with the Western Electric sound on 1250
film, because they had no camera. The light valve was their means for recording sound on film. The Fox System and the Tri-Ergon System used a flashing lamp.

This light valve in the Fox studios by that time in 1927, was all experimental. They never turned out a foot of film commercially until long after. The first sound on film, I believe, that Western Electric turned out commercially was in 1928. This matter was in 1926 and 1927. And I am able to fix the date on that because of a very interesting fact. The Fox Company, through 1251
the Fox Case Corporation and Fox Movietone News actually recorded pictures and sound in China, news pictures in China. We had reached that part of the world before the other companies had signed a contract, before Western Electric had even begun to make a foot of sound on film, the Fox interests were that far ahead at that time.

As to the requirements of Western Electric, that Fox should use the light valve, that was part of the contract. Their contract provided, as I said, that they must decide what kind of

sound, that meant sound on film or sound on disc, and what kind of equipment be used. They were always desirous of our using the light valve. They recognized that we were far ahead, so far as commercial requirements were concerned—

Mr. Neave: I object to what they recognized.

1253 The Court: Yes, strike that out.

The Witness: I will state it this way, then: We were far ahead for the reason that we were commercially recording and reproducing sound on film with the glow light, whereas there was no commercial recording or reproduction of sound with the light valve at that time. They never pressed the point that we use their equipment, when it would have obviously been impossible for us to have done so, or unjust to us to have done so.

1254 Q25. At whose expense was this light valve equipment put up in the Fox studios? A. I do not think they ever charged us anything. I think they supplied the equipment; I think even they paid for some of the film they used, although I remember we had a long dispute about that at one time, but how it was adjusted, I do not remember.

There has been some statement made here about the inferiority of the glow light with respect to the light valve. In observing the operation of the two, there never was an instance or a foot of film recorded by the glow light that

1255

was not infinitely superior to the light valve, as long as I was with the Fox Company.

That is, in later years, I observed the films recorded by the light valve, and those Fox was recording by the glow light, and I personally observed the difference between the two, hundreds of times. Of course, later the comparisons were public property, because all of the Fox recording was with the glow light and all of the Western Electric licenses such as Paramount, Metro, Universal, used the light valve in their sound on film.

1256

As to whether the Fox Theatres, up to the time I left them, used the disc reproduction system at all, well, not for their own films, but they were equipped to reproduce with disc, because they often ran Warner Brothers pictures which were entirely supplied on the disc. In the early development it was not true, but in the later development of sound in connection with pictures, the equipments were put in for both disc and sound reproduction. They very first equipment put out by Western Electric was for disc only at the Warner's Theatre on Broadway, or I think it was the Winter Garden, no, the Warner's Theatre, and all the Warner installations were for disc reproduction only. They had to change later to reproduce sound on film, because so much of the material was supplied with sound on film; but also conversely it is true that the Fox installations, although they were primarily designed to reproduce the Fox material which was, sound on film, they also had to equip themselves in the later days to reproduce on discs, for some of the material, such as the Warner pictures, were supplied only on disc.

1257

1258 *Courtland Smith—For Plaintiff—Rebuttal—Direct.*

But today it is admitted generally that there is no demand for disc reproduction, it is all the reproduction of sound on film.

It is very difficult for me to conceive of any argument in favor of sound on disc, for the simple reason that the picture is on the film.

Now, if one can get a satisfactory reproduction of sound on film, and it is satisfactory because all the recording and reproduction today is on
1259 film, why would one need another element, particularly when that element is subject to grave difficulties in the actual motion picture business, such as when the film breaks, as all film breaks in going through the machine from time to time, the film naturally shortens, every patch takes out so much of the picture. If the sound is in connection with the picture, then an equal amount of sound is taken out. There is a jump, but the jump is no more in sound or no less in sound than it is in the picture. Whereas, if it is on disc, every time you shorten the film, you put
1260 the sound ahead of the picture, because you cannot take a little sound out of the disc.

Furthermore, there is a far greater difficulty in synchronization, for the operators are often careless.

Also there is the actual opportunity which has happened thousands of times of getting the wrong disc for the print. Therefore, you can sometimes have a man singing, when you have the disc of something entirely different.

Also there are censorship boards throughout the United States, and they cut out five feet, ten feet, or a hundred feet of a picture. How can

1261

you cut that out of the disc, how can you take the equivalent sound out of the disc?

Those are the arguments that Mr. Fox, as a practical film man used when he had to decide, which was a very important question to him, whether he should have sound on film or sound on disc. We were not experimenting, we were not—Mr. Fox had millions invested in the motion picture business. He was one of the leaders of that industry, and his decision was a very important decision to make, and he made it very 1262
carefully and with full knowledge of the requirements of the motion picture industry.

With all due respect to the Western Electric, they were not in the motion picture business at that time. They were beginning to be interested in a very important part of it, but they were not practical and experienced film men, and I think that is the reason that they went wrong at the start and developed sound on disc. They later changed, and all of their recording today for the motion picture companies is sound on film.

When Fox Case started out they had what 1263
they called the Movietone wagons, going around to take sound pictures. Those were their equipment for the Fox Movietone News. The Fox Movietone News was probably the biggest, in my opinion, Fox Movietone News was the biggest single reason for the successful introduction of sound into the motion picture business, because it showed not only that there was a tremendous demand on the part of audiences for sound, they responded tremendously to such a feature, but it showed it was practical to record pictures with sound anywhere anything that could be photo-

graphed in silence, and today that has been proved to be the case.

About the Tri-Ergon apparatus, the system being brought over by Mr. Joy, Mr. Joy left the United States either the end of July or—I remember distinctly that the Tri-Ergon equipment landed in New York, either in the middle of December, 1926, or toward the close of that month. It was immediately set up first at 10th Avenue
1265 and 55th Street studio, which was a very large floor, and I remember a lot of the equipment being scattered all over the floor. And then later, it was brought down and used in competition with or in comparison with the Fox Case equipment in the studio at 10th Avenue and 54th Street.

I did have occasion to compare the merits of the sound and pictures, the Fox Case sound and pictures with the Tri-Ergon system and the disc sound pictures, that system of Western Electric at that time.

1266 Q34. To what extent did you have occasion to observe it? A. Well, practically to a daily extent. That was my only work for several years.

Q36. And what is your opinion as to the relative merits of the three, as you saw them at that time? A. I think easily the Fox Movietone or Fox Case, which it was, was No. 1, as being best in quality. At that time I would have preferred the Tri-Ergon sound on film to the Western Electric sound on disc.

Q37. I believe you stated that at that time Western Electric did not present any sound on film for comparative tests? A. They presented it for laboratory tests, but it was not in satis-

factory shape at that time, and wasn't for some time thereafter.

Q38. Did they ever at that time present any to you for your laboratory, any sound on film for comparison? A. They did, later, about the summer or fall of 1927. They then had developed a camera to record sound on film, and after a great deal of experimentation, they showed some results. And I even then would have preferred, at that later period, I would have placed in the 1268
later period, comparing the disc machine with the Fox Case sound machine, I would have placed the Fox Case sound as first in quality. The fact that it was easier to handle was obvious, because we were at that time, after March, 1927, actually recording news events.

The first time sound news shots were taken was at West Point in March, 1927. That crew immediately left for Italy, and actually recorded Mussolini in Italy in May, 1927. At the same time, toward the end of May, 1927, one of the great historic events of all time, Lindbergh's flight to Europe, was actually recorded by Fox 1269
Case sound-on-film, and the films were thereafter shown. That was one of the biggest news stories ever photographed, and was one of the reasons for the tremendous interest in sound pictures. To show how feasible sound-on-film pictures were at that time, the Fox Laboratory got their negative in the morning, and in the afternoon we were showing the picture on Broadway.

Q39. Now, did you or did you not give access to the Western Electric people to your film work both as to Fox Case and Tri-Ergon in 1926 and 1927? A. Oh, yes, they had access at all times

1270 to all of the work that we were doing, either in Fox Case or with the Tri-Ergon. You know at that time we had not purchased, or Mr. Fox had not purchased, any interest in the Tri-Ergon. He had an option, and we were seriously trying to check it, and the Western Electric were helping us to find out as to what there was to it. The Western Electric engineers followed every bit of the work that we did, and with our full knowl-
1271 edge and permission, both in the studios and outside the studios.

Q41. Some testimony has been given here in regard to some committee being formed of representatives of these companies you have mentioned, to investigate the Tri-Ergon system. Do you know anything about that? A. We had committees for everything; we had committees of engineers to investigate and follow every development of the work, the laboratory work, the recording work, the reproducing work. I do not know what committee you refer to.

1272 Q42. I refer to a committee where a committee was appointed to investigate the Tri-Ergon system when it came here. A. Yes, that is true, there was such a committee appointed by me. The committee was appointed to follow out the general course that we followed in all this work, and that was to have everybody connected with the work familiar with what was going on, to criticize and suggest and be in a position to take advantage of any development.

I appointed the committee. First I remember it was composed of a large number. I do not know, I do not remember who they were, but Mr. Joy, who was really in charge of the Tri-Ergon

work, or this development, under Mr. Fox, but who reported to me, he objected that we had too many Western Electric and Fox Case men on the committee, and then I made the committee smaller.

The committee at the start I think was Mr. Joy and Dr. Engl, Dr. Engl, who had come over from Germany with the Tri-Ergon equipment, and was really technically in charge of it, and as I remember, was one of the three men, the 1274
Tri-Ergon was made up of three men, and Dr. Engl was one of the three inventors. So it was Mr. Joy and Dr. Engl representing what we might call the Tri-Ergon interests, Mr. Sponable, who was the chief engineer for Fox Case represented Fox Case, and I believe Mr. Drake, and Dr. Crandall, who died, represented the Western Electric.

That commtitee held several meetings, or they were in session as all those committees were, most informally, but all the time. I remember the first meeting we had, they had a dinner and I attended it. I tried to attend some of the in- 1275
formal meetings of all the committees, not that I was in any way technical, but the general development of this work was under my supervision, and I had to keep in touch with it. Thereafter they had some meetings. I remember both Mr. Joy talking to me about it and Mr. Sponable talking to me about it. I believe Mr. Sponable was somewhat jealous of Tri-Ergon, and I believe Mr. Joy was somewhat jealous of Fox Case, and I believe that possibly the Western Electric—well, I can't speak for them.

I remember many times Mr. Joy and Mr.

Sponable, who were both reporting to me, talking to me and criticizing and complaining, and so forth.

As to whether Mr. Fox exercised his option after this trial and investigation of the Tri-Ergon system, he exercised part of his option. His option was both for the rights for the United States and Canada and Mexico, on the one hand, and world rights on the other hand. The price,
1277 as I remember it, was $60,000 for the United States and $100,000 for the world rights.

Mr. Fox, at the expiration of the period, the option period, which I believe ran six months, exercised the rights to this country, and he obtained an extension of his world option rights.

This $60,000 was a cash consideration, and there were also some stock considerations, I believe he had to give 10 per cent of the stock of a company that he obligated himself to form to them.

Q47. Can you state when the Fox Case started
1278 using the method of taking the sound and picture records on two separate negatives, and then separately developing them and then printing the sound and picture records on one positive? A. I do not believe Fox Case, as I remember it, Fox Case did not do that until we went to the coast, Hollywood, where, for production purposes, sound and picture recording on two different pieces of film were very much desired.

Q49. Now, do you know anything about the physical condition of the Tri-Ergon apparatus when it arrived here? Was the apparatus in satisfactory condition when the tests were carried out, were there any handicaps? A. It had

1279

been badly damaged in shipping, and it took some time to correct it and fix it up.

The Western Electric people were, at the time that they came in to carry on this investigation, given access to the Tri-Ergon patents, we supplied them either with copies of the patents or with the numbers. I imagine that they had all those themselves. I don't remember whether we actually supplied them with the patents or gave them the patent numbers, but we gave them all 1280
the information we had concerning it.

I was subpoenaed to testify here. I said practically I would be willing to testify if I had facts that would interest anybody, but I would have to be subpoenaed. I said that I did not desire to testify, but that if I were to be subpoenaed and my testimony was important, I would, of course, accept the subpoena.

Cross Examination by Mr. Neave:

The Western Electric or any of its interests did not join with Mr. Fox in exercising the option on the Tri-Ergon matters for any rights. 1281
They were given full opportunity to do so at their request, to come in and join in the exercise of the option and pay some of the money and get some of the rights, only so far as the world rights were concerned, not so far as the rights for this country. In fact, it was due to their request that they be permitted to enter into a part ownership of the world rights that the option was extended for the world rights, and for a period of about eight months they were very actively interested in joining in exercising those rights. Then, they suddenly stopped and they did

not exercise the rights and they asked Mr. Fox not to exercise those rights. That period of eight months began some time after or immediately after Mr. Fox purchased the American rights, which must have been about June, 1927. Now, these dates may vary by a month or two. I am only quoting them from memory.

XQ60. Prior to that time, Mr. Fox or his interests had wished the Western Electric Com-
1283 pany or offered to the Western Electric Company to come in with him on the exercise of the option that he originally obtained? A. No, I would not put it that way. The Western Electric asked Mr. Fox for permission to come in on the world rights if he exercised them or if they wanted to exercise them.

XQ61. I am talking of a period prior to that time, prior to the time when Mr. Fox exercised the option on the American rights. Wasn't there any talk then of the Western Electric Company joining in the exercise of the option on the Amer-
1284 ican rights? A. No, Mr. Fox never opened up the American rights for the Tri-Ergon to anybody but himself.

XQ62. Mr. Drake testified to the contrary. Does that refresh your recollection at all? A. No, it does not, because I had sat alongside Mr. Fox for several years, and these matters were in daily discussion between us, and to the best of my knowledge and recollection, and I think everything will bear it out, Mr. Fox reserved at all times the American rights to the Tri-Ergon for himself. He was willing, if the Western Electric wanted to come in, to either have them in as a part owner, or turn over to them the world

1285

rights, exclusive of America. I first got in touch with the Western Electric Company in connection with these matters about September, 1926—I mean about all sound matters. About the Tri-Ergon matters, about the time that he (Engl) was due to come over here, which was about November or December, 1926; we disclosed to them that there was this German situation, and they knew that we were trying to work out an option which we finally secured. They knew that we 1286
had requested the shipment of apparatus, and they knew when it was received.

The committee I spoke of was not appointed, obviously, until Dr. Engl came over here for the first time, the first time, so far as I knew.

Prior to that time, I said that the Western Electric engineers, together with the Fox engineers were working in the Fox Case studios. You see, there never were Fox studios in New York, at that time. It was Fox Case, another company.

XQ69. And you said, I think, that all of the 1287
work on sound on film was being done in those Fox Case studios, and that no one else was working anywhere else in the country on sound on film? A. Well, DeForest might have been working. I will have to correct it to that extent, and also the General Electric Company, that is right. The Western Electric were working in the laboratories, and they were working in the Fox Case studios, as I said.

They were working in the Bell Laboratories, but that was not commercial. In the motion picture business we never regarded anything that was not commercial, that was not put out to the

1288 *Courtland Smith—For Plaintiff—Rebuttal—Cross.*

public, as of any particular importance at the time, because, after all it was what we had to show to the public that ran our business.

XQ72. Then, in addition to the work which was being done on sound on film in the Fox Case studios, the General Electric Company was doing work and DeForest was doing work and Western Electric was doing work in their laboratories? A. I don't know whether DeForest had
1289 been doing work. DeForest was the first one in this country, I believe, to show publicly sound on film. That was in 1922 or 1923.

XQ73. Then, when you said that all the work on sound on film that was being done in this country was being done in the Fox Case studios—You don't know that to be the fact, do you? A. I know that to be the fact, that the commercial work, the work that was shown to the public, was being done then, all the work that was being done on sound on film that was commercial, in other words, that was being shown to the pub-
1290 lic, was then being done at the Fox Case studios on 10th Avenue and 54th Street.

When I used the expression in one of my answers to Mr. Ward that, "that development of theirs came later", I was there referring to Western Electric Company development of sound on film.

XQ76. How do you know the work was not done earlier in the laboratories? A. Because we were in just as close contact with them as they were with us.

XQ77. You went to their laboratories every day? A. Oh, yes—not every day. I went through many times.

1291

XQ78. Do you think you went through all their laboratories? A. Unless they had something up their sleeve that they hid from me, and I don't think they did, because we played perfectly fair with them.

In September, 1926, I began to know about work that was being done by the Western Electric and associated laboratories. I know all the work up to that time because they told me of all their work and showed it to me. I will tell you 1292
how I knew it: because the other big companies, when they signed the Western Electric contract, that was the first time the Western Electric ever tried to put out commercially sound on film.

XQ83. You are talking about commercially. A. My dear sir, the only thing that I can talk about is the commercial angle, because in the motion picture business, whatever we have in the laboratory—

> The Court: We have had that. You have said that before, that you did not regard anything but the commercial output. 1293

I would not attempt to answer how much of the apparatus is common to the sound on disc and sound on film, because I am not technical enough to know. I can state it broadly, but I could not be held to the answer my training and experience have not been along technical lines, but rather along executive commercial development lines. As to what the technical men of the Western Electric Company or its associates reported as to the Tri-Ergon apparatus, I can only tell you what they told us. I cannot tell you what they reported to their own people. They did show

1294 *Courtland Smith—For Plaintiff—Rebuttal—Re-direct.*

great interest in it. They did not join in getting the rights. At the end they did not, there is no question about that.

Re-direct Examination by Mr. Ward:

I said that in addition to our giving the Western Electric access to our work up at the Fox studios, they also gave us access to their laboratory work. I was in their laboratory on various
1295 occasions. It was the understanding that they were to show us what they had done up to the time, and open up everything. Obviously, they were under pledge to us to be as frank and as open to us about their work as we were to them, and I have no reason to believe that either side ever cheated in the slightest in that respect. At this time in their laboratory, or when I was examining or inspecting or going through their laboratory and getting their information, what they had to disclose with regard to sound on film, was what might be known as a laboratory
1296 demonstration. They could run film through and reproduce it. In my opinion, it was not satisfactory. They had no camera in which to photograph the picture and the sound, either on the single system or the double system. That development of theirs came later. If you want me to testify about the quality of the sound on theirs, I can only repeat what I have said before, that in my opinion, at that time, and that time covers a period of several years, the quality of Fox Case sound was superior to the quality of any other sound on any other system manufactured by anyone else, either sound on film or sound on disc.

William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Direct. 1297

WILLIAM C. BALLARD, JR., resumed.

Direct Examination (Continued) by Mr. Ward:

Q354. Mr. Ballard, you called my attention to one or two corrections you wished to make in the answers to the last two or three questions now on the record. Will you please refer to those and state what corrections you had in mind there? A. In the answer the Q352 appearing on page 677 of the record, in which I was asked: 1298

> "In addition to the differences in length what have you got to say with respect to the differences in cost, in the two cases?"

The answer was:

> "For each negative film many positive films are produced. As many as several hundred prints may be made of single negative film. This operation would have to be gone through once for negative film 1299 and perhaps several hundred times for corresponding positive films."

What I had in mind was, in speaking of the term "this operation", was, of course, the cementing operation, that the negative film had to be cemented but once, whereas each of the several hundred positive films must have to undergo this process, and I would like to correct that statement by inserting the word "cementing" between "This" and "operation".

In answering the next question, it does not seem clear that I had intended to point out that

1300 for a given variation from the exact condition of perpendicularity of the slit to the motion of the film, a slight percentage of variation would be ten times as important in the use of a slit one inch in length as it would be in the case of a slit 100 mils or one-tenth of an inch in length.

Q355. Are you referring there to your testimony on page 678-A? A. That is correct, in answer to Q353.

1301 Q356. Do you know if the alternative suggestion of the Bullis patent of connecting the sound and picture films together has gone into commercial use? A. As far as I know, the system of producing two positive records on separate film and cementing them together for reproduction has not gone into commercial use.

Q358. Will you please state briefly the type of sound record that Bullis shows in U. S. patent No. 1,679,708 issued August 7, 1928? A. This patent has to do with an electromagnetically recorded and reproduced sound record.

1302 Q359. Explain a little more in detail just how the record is constructed; that is, what is it? A. The record is produced by passing a flexible strip of magnetic material past an electromagnet whose—

Q. I did not mean that so much, but describe that film as shown there in the drawing. Is it metallic or celluloid, or just what is it? A. It is a combination of a metallic and celluloid strip. The metallic strip is produced in which the picture openings are punched out and the celluloid strip pasted or joined in place in some manner to reproduce the picture when this combined film is exhibited.

William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Direct. 1303

Q361. That is, there is a metallic frame, one part of which is left for the sound record and on the other part of the metallic frame the picture film is secured? A. That is right. The patentee further makes the statement, beginning line 7, in this later Bullis patent, 1,679,708:

> "While it has been heretofore proposed to combine a sound and picture record photographically on the same film, it has 1304
> been difficult to successfully carry out this scheme chiefly for the reason that different manipulation and treatment of each record is required in the developing of the picture record and sound record to obtain the best results, and this is not possible where both records are photographically made on the same film. I have found that when recording of the sounds is accomplished photographically, the two-film method as set forth in my patent No. 1,335,651 of March 30, 1920, is the most 1305
> practical when a photo-electric cell is used to reproduce the sound."

Q363. Referring to the other Bullis patent No. 1,335,651, is the process of Bullis as to each method suggested by him, the same as or different from the process of the patent in suit and defendant's, that is, in your opinion? A. It is different from that of the patent in suit and that employed by the defendant, in my opinion.

Q364. Will you please take the chart, Exhibit No. 22, and point out to the Court to what extent you find the process of Bullis and the pat-

1306 ent and the defendant's process in common and to what extent apart? A. The Bullis patent advises of separate exposure of the sound stock, separate development of the sound stock, printing from the sound negative onto a sound positive, developing the sound positive, and with a final result of a separate sound positive record. The same action is gone through for the picture stock. The picture is first exposed on a
1307 single strip of negative film, developed separately, printed into another separate strip of positive picture film, separately developed, and producing a second independent strip of positive film on which the picture is recorded. These two strips then are used for reproduction purposes.

There is no combination in action as is in the defendant's process or in the patent in suit where the two separate films are printed together on a single film and this second film dedeveloped to produce the final product.

Q365. Then, as I understand your answer, of
1308 the four steps of the defendant's process and the process of the patent in suit, Bullis parallels the first two and then differs from there on? A. That is true.

Q366. Then, in the Bullis alternative or supplemental suggestion, where he brings the separate sound and picture positives together and cements them together, that would constitute still another or fifth step in Bullis which is not the defendant's or the patentee's process? A. That is true.

Mr. Ward: I offer in evidence a copy of the Bullis patent No. 1,679,708, in re-

spect to which the witness was questioned a few minutes ago, to be marked Plaintiff's Exhibit 30.

(Marked Plaintiff's Exhibit 30 in evidence.)

Q367. Will you take the Craig patent No. 1, 260,337, and explain to the Court the process disclosed in that patent, referring to such parts of the specification as you deem advisable to 1310
clarify? A. This patent refers to a phonographic attachment for moving picture machines and the production of sound and picture records. The system to which the disclosure of this patent is directed consists of a process in which the visible picture and the sound record are so constructed and recorded that they may overlie one another without interfering in the effective reproduction of each other. The patentee describes that the sound and picture negatives are made upon separate photographic films of ordinary construction and the picture record is then reproduced 1311
by ordinary photographic reproduction methods of pictures on one side of the film, and on the back of the film and opposite the picture records, as far as the back and front of the film are concerned, another sound record is produced designed to be reproduced by the action of infrared rays.

The description of the picture record is stated at line 5, page 3:

> "If a film is prepared, therefore, having on one side the ordinary photographic reproductions of pictures, and on the other

1312 *William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Direct.*

side a phonographic sound record, capable of being reproduced only by infra-red rays, the sound record will not interfere with the passage of white light to and through the pictures and the presence of the pictures will not interfere with the passage of infra-red rays through the strip."

Several different systems of reproduction are
1313 described, among which is the Edison tasimeter, the selenium cell and the bolometer.

The picture records in their final positive form are produced by reducing from the film of silver halides, as is customary in the ordinary photographic reproduction methods of a coating of reduced metallic silver. On the back of the film, the patentee desires to form a sound record of some material which is completely pervious to visible light, such as would be used for reproducing the picture, and impervious to infra-red
1314 rays.

There are a number of nebulous suggestions as to how this sound record on the back might be produced. For instance, the patentee suggests the use of cuprie chlorid. As is well-known, cuprie chlorid is of itself a deep blue color, and any considerable deposit of cuprie chlorid would be reproduced on the screen as blue lines of varying intensity. Water. It is difficult to see how water may be used to produce an infra-red record, and even notwithstanding the fact that the patentee describes the use of water by attempting to use it as water of crystallization, it is a well-known fact that in the normal repro-

duction of pictures, the intense light from the reproducing arc causes a very high temperature at the film itself, so that if it were possible, which it does not seem to be at all evident, to produce initially a record made in water of crystallization, this record would probably be destroyed, due to the high temperature of the projecting arc.

I know of no method by which a sound record could be made using oxygen or carbonic acid gas, 1316
nor with the use of very thin metallic silver or selenite. Selenite, as has been pointed out previously, is crystallized gypsum. Obviously, it would be extremely difficult or impossible to use it in the crystalline form, and when it is powdered, it is normally opaque.

Alum is of interest principally from the standpoint that it contains water of crystallization, and this would be, of course, open to the objection that the alum, under the intense heat produced by the projecting arc, would probably be desiccated. 1317

In order to have this disclosure operate satisfactorily, two things are necessary. One is that the picture record must be completely pervious and transparent to infra red rays, and the other is that the sound record must be completely transparent or pervious to visible light.

It is a well known fact that the reducing effect of ordinary photographic emulsions is not completely pervious to infra red rays. In fact, it has a very decided impervious effect, and it is quite obvious from the process described that the sound record would not consist entirely of

the sounds reproduced on the back of the film, but would consist of a jumble of unintelligible noises produced by the passage of the picture record in the path of the infra red rays.

The reproducing equipment described is very interesting in showing that the patentee had very little idea of the requirements of sound reproduction. One type of apparatus proposed for use in reproducing is the Edison tasimeter. This is
1319 shown in Fig. 10. In Fig. 10 element 41 is a rod of hard rubber or vulcanite. The infra heat rays are allowed to fall on this rod of hard rubber, and in doing so, they have some heating effect. The heating effect of the infra red rays then tends to elongate the rod to a greater or lesser degree upon the carbon granules shown in Fig. 3.

It is quite obvious that in order to reproduce sounds such as those encountered in talking pictures, that this rod would have to heat up completely, cool, elongate and shorten in length at a rate of several thousand times per second,
1320 which, I think is obviously impossible.

The same criticism applies to the reproducing equipment indicated in Fig. 9, which is known as a bolometer. In this case, one of the resistance arms of a wheatstone bridge arrangement is caused to vary in resistance due to the impinging infra red heat rays thrown upon it from the sound record. It is a fact that the action of the normal type of apparatus of this character is extremely sluggish and it would be impossible to reproduce any of the high frequency variations encountered in sound by this system of alternately heating and cooling the wire 39 of the Bolometer.

William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Direct. 1321

A third suggestion for reproducing the sound record is to use a selenium cell. As is well known selenium cells are sensitive not only to infra red rays, but also to visible light.

Q368. You have mentioned certain substances at lines, starting at line 35 on page 3 of this patent, that is substances, suggested by Craig. What have you to say in regard to certain other substances that are referred to commencing at line 30? A. I do not understand that he pro- 1322
poses the use of the three substances mentioned on line 32 for the production of the invisible sound records. It is quite obvious that bromin, being in normal condition, that is at ordinary temperatures, could hardly be used for the production of a sound record, particularly in view of the fact that it is definitely stated beginning line 7 of page 3 that the picture record is to be produced by the ordinary photographic reproduction of pictures.

Vulcanite is the scientific term for hard rubber. Perhaps he had in mind the cutting out of 1323
some series of silhouette figures from sheets of hard rubber; I do not know.

Q369. What have you to say with regard to the suggestion of Craig of using the ordinary photographic reproduction of pictures, and then with respect to using thin metallic silver as to the sound record, as I understand it? A. The final results in the system known as the ordinary photographic reproduction of pictures, in my estimation, is the reduction to metallic form of certain silver halides so that the black portion of the picture that we see is actually a finely deposited series of silver grains. These, of course,

must be thick enough to cut off visible light. Craig suggests that the metallic silver, so then as to be transparent to visible light, may be used for the infra red sound record; and it is quite obvious that thin metallic silver, so thin as to be transparent to visible light, and cut off infra red rays, then silver thick enough to completely cut off the visible rays, will cut off invisible infra red rays to a proportionately greater degree.

1325 Q370. Now, Craig, mentions in his specification, a modification wherein he may have two sound records on the same side of the same film. Will you state under what conditions he proposes to use those? A. The double sound record shown in Fig. 8 is recommended in cases where it is desired to record simultaneously from two different plates on a given picture set; and to reproduce the two sound records from reproducing equipment stationed at equivalent positions in the reproduction.

Q371. When he uses the two sound records on
1326 the film as shown in Fig. 8, what does he disclose as his proposal for the use of the other side of the film? A. The other side of the film is to be used, the full width of the other side of the film is to be used for the production of the visible, of the picture record.

Q372. That is, if he wants to produce a sound picture in which a dialogue is carried on, he would print the pictures of the two parties across the one side of the sheet, on the face of the sheet, and then he would print the two separate sound records on the other side of the sheet, having the sound record of one party's speech overlying that party's image, and the sound record of the

other party's speech overlying the other party's image or images, is that right? A. I think that is correct.

Q373. Do you find anywhere disclosed or suggested in this patent any type of sound and picture film, other than one where the picture record overlies or underlies the sound record? A. I do not.

Q374. Do you find that to be the object and teaching of this patent? A. I do. 1328

Q375. Now, I refer you to Craig patent 1,260,338 of March 26, 1918, which you stated to be a division of the application resulting in the other patent. Do you find the double sound record shown in Fig. 8 there with the pictures completely overlying the two sound record? A. Fig. 8 shows the double sound record with pictures overlying the sound record.

Mr. Ward. I offer in evidence Craig patent 1,260,338, a copy of it as Plaintiff's Exhibit 31.

(Marked Plaintiff's Exhibit 31 in evi- 1329
dence.)

Q376. Professor, I refer you to the Craig specification, page 4, commencing at line 113 in patent 1,260,337 and direct your attention particularly to the statement in line 19, the language:

"Photographically printed upon one film or upon opposite sides thereof."

Mr Jones, Defendant's witness, testified in substance that while Craig did not disclose any

system or method, other than one in which the pictures and sounds were superimposed, or one overlying the other, yet that this language, in his opinion, would infer to him that Craig had in mind using a film in which the picture and sound might not be, one on the front and one on the back or on opposite sides. Will you please state whether you agree with Mr. Jones on that and give your reason for your answer? A. I do not
1331 agree with Mr. Jones in this respect. There is nowheres in the patent any disclosure of a method by which the sound and picture record could be produced on the same side of the film; and no reference throughout the patent is made to this condition. The line following the one reference was made to states, this is beginning line 120:

> "In printing these records, the picture record would be printed as usual on one side of the moving picture film and fixed, the fixing solution however not being al-
> 1332 lowed to touch the other side of the film or strip."

It is quite evident that the patentee was desirous of describing a system in which these two records would be kept separate and located on opposite sides of the film.

Q377. And is it a fact that the whole specification with its complications is directed to the attempted solution of a problem where picture and sounds are to occupy the full film, that is, the pictures on one side and the sound on the other, one overlying the other? A. That is true. There would be no point to these complicated treatments, if such were not the case.

Q378. Is what you have testified to with respect to the disadvantages of a large sound record with reference to the Bullis patent, does that also apply to Craig? A. That is also true in connection with Craig.

Q379. Do you know whether anyone, as far as your knowledge goes, has used or uses this Craig process for the production of sound and picture records? A. So far as I know, no one has ever been able to make a satisfactory film by the 1334
Craig process.

Q380. In your opinion, is the Craig method disclosed in his patent, an operative one? A. It is completely inoperative for many different reasons.

Q. 381. In your opinion is the Craig process different from or the same as the process of the patent in suit, and the defendant's process? A. It differs from both the process described by the patent in suit and that used by the defendant.

Q382. I refer you in the patent in suit to page 1, commencing at line 9, down to line 26, which 1335
deal with the problems of development with respect to picture and sound records. You heard Mr. Jones' testimony, which, in substance, as I recall it, was that the idea disclosed by the patentees here was different developments for different parts of the picture sequence rather than different developments for the picture sequence and the sound record. What have you to say on that matter? A. I do not understand that this is what the patentee had reference to in the specification.

Q383. Will you give your reasons for your answer? A. May I have the question repeated?

1336 *William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Direct.*

(Question 382 repeated by the reporter.)

A. This is clearly pointed out in line, beginning at line 16: "As the same film, however, carries close to the picture sequence, the normally exposed sound sequence." It is not difficult to maintain normal exposures in sound sequences, and the difficulty lies in getting the proper degree of exposure in the picture sequence so that the pic-
1337 ture sequence may be under or over-exposed with respect to the sound sequence.

Q384. That is, it is your opinion that the contrast drawn is one of under-exposure or over-exposure of the picture sequence with respect to the sound record? A. That is correct.

Q385. Will you refer to the German Reimer patent 279,598, and state briefly and generally what that patent discloses? A. This patent discloses a proposal to obtain sound with motion pictures by a system in which the picture record is made in the usual way, and at the same time
1338 the picture record is made, a phonographic cylinder or disc record is made. This disc or cylinder record, after having been appropriately treated, is cut into strips so that it may be joined with the picture film and reproduced in the normal phonographic way, that is, by the mechanical motion of a stylus following the indented grooves on the sound record. There is no photographic recording of sound in the entire patent.

Q386. That is, it is simply taking a phonographic record, either on a cylinder or disc, and in some way that may or may not be possible, they cut a long strip, fine strip of that record from either the cylinder or disc, and then pro-

 1339

pose to paste that onto an ordinary picture film? A. That is correct.

Q387. And then they propose to take that sound off by a stylus or what? A. In the ordinary phonographic method, using a phonographic needle or its equivalent.

The Court: There wasn't any question about that anyhow, was there? That was offered simply because of the provision on 1340
page 2 you have the two combined on one side, the sound and the picture.

Mr. Ward: Yes, they set it up as an anticipation.

The Court: Yes, but that was the purpose of it, wasn't it?

Mr. Ward: Your Honor was referring to page 2?

The Court: Yes.

Mr. Ward: Yes.

Cross Examination by Mr. Ashton:

XQ388. Do you recall your testimony, Professor Ballard, regarding the Greensfelder patent, and particularly with respect to Fig. 5 of that patent? I understood you to say that the sound record shown in Fig. 5 was a negative record, whereas the picture record of Fig. 5 is positive record. Is that your testimony? A. I do not think I called the left hand film a sound record, no. Because I have never considered it such, Mr. Ashton.

XQ389. You stated the one was positive and the other negative? A. Yes.

XQ390. I think you also stated that this opinion of yours was based upon the statement of the patent at page 5, beginning at line 128? A. Page 5?

XQ391. Yes, page 5, line 128. The statement is, "A convenient way to obtain the film 40 is to first photograph a negative of the original sound film and place it side by side with a finished and pieced negative of the corresponding picture film,
1343 then from the two print a one-piece double-width positive such as shown in Fig. 5."

XQ392. You know, don't you, Professor Ballard, that the original sound film there referred to is the perforated film on which the film of Fig. 5 is made? A. I do not understand that any perforated film was used anywhere in the process.

XQ393. You understand from the patent, do you not, that the film of Fig. 5 is to have transparent sound marks on it? A. Yes, it is, partially transparent and partially opaque.

XQ394. Are not the sound marks themselves
1344 transparent? A. As I interpret the patent, when the action is to take place an opaque portion should be in front of the reproducing slit.

XQ395. I call your attention to page 2, beginning at line 76, where it is stated: "A shelf 9 is placed at a suitable point between the lens 6 and screen 7, or at the screen 7, so as to intercept the rays of light 10 coming from the film through the 'sound marks' 3."

Is not that a statement that the sound marks are transparent? A. I do not think that necessarily follows, Mr. Ashton, at all.

XQ396. Are not these sound marks also referred to as transparent on page 2, beginning

at line 53? A. I am not sure as to what the patentee means by sound marks. If by sound marks he means the mark extent while the action is not to take place, then I should be willing to state that the sound marks are transparent. If by sound marks that show on the film that is being reproduced when the action was to take place, then I can see no basis for it.

XQ397. Have you ever read the disclosure beginning at line 39, page 2 of the patent? A. 1346
Yes. This, of course, refers, as I take it, to the disclosure of Fig. 3 and not that of Fig. 5.

XQ398. What do you base that statement on that it does not relate to Fig. 5? A. I see no statement there that it does relate to Fig. 5; he has been talking about Fig. 3 up to this point.

XQ399. You made some statements as to the operation of Fig. 1. A. Yes.

XQ400. I would like to ask you if you have read line 121, page 2 of the patent? A. I have read the entire patent several times, yes.

XQ401. Does it not state there that the electro-physical change is relied on for the purpose of closing the electric circuit including the battery 15 and energization of the corresponding electro-magnet? A. That is true.

XQ402. That is, if you look at Fig. 2 the light falls on the selenium cell 11 which operates the relay 14 and closes the circuit including the battery 15 and causes the electromagnet 16 to operate the piano control 17? A. To which selenium cell 11 are you referring, Mr. Ashton?

XQ403. I call your attention— A. There are three.

XQ404. Any one of those three. The three are connected up in different ways.

XQ405. Refer to the one that is marked 11. A. Yes.

XQ406. Is my statement correct? A. Your statement is not correct with respect to that one marked 11.

XQ407. Is it correct with respect to the left hand one? A. No, that is not a true statement.

XQ408. Will you please state the way you understand the operation to be? A. There is a very definite way in which the system must operate according to Fig. 1 when the light impinges upon the cell 11 of Fig. 1—that is not shown, but is referred to as being on shelf 9. The cell lowers its resistance, allows a greater circuit to flow from the battery 13, and pulls up the armature of the relay 14. This opens the circuit of the battery 15, and that energizes the magnet disc 16.

XQ409. This is your understanding of the operation? A. I see no other way than to interpret it in this manner.

XQ410. You referred in your testimony on Friday to the statements in the patent in suit and in the application as originally filed in which the two records may be pasted together. You did not intend to suggest at that time, Professor Ballard, that the patent did not contemplate that the two separate films of Fig. 1 could not be pasted together or secured together in making the final film of Fig. 2, did you? I am referring now to the patent in suit. A. I do not see how that would be possible, Mr. Ashton,

because the two films of Fig. 1 are both negative films, and the film of Fig. 2 is a positive film. It is quite obvious that you could not paste two negative films together and get a positive film out of it.

XQ412. The patent in suit states, does it not, page 1, beginning at line 79— "One can, however, previous to the printing, unite longitudinally together the two developed negative films, and then copy this so united negative in the 1352 usual manner"? A. That is correct.

XQ413. Do you not understand that that applies to both Fig. 1 and Fig. 3 of the patent? A. My criticism was directed to the fact that you referred to Fig. 2 and Fig. 1 together, and they show different types of film. One shows a positive and the other shows negative film. I had no intention of indicating that the statement given by the patentee was impossible to perform.

XQ414. You stated on Friday in connection with the Bullis patent that there were certain 1353 objections to the use of two films, and particularly you referred to the patent in suit and stated that when the patent in suit suggested pasting the two films together, that that had to be performed only once. Was that your testimony? A. It has to be performed once in the production of the picture because one negative is used as a usual thing to produce a number of positives.

XQ415. About how many positives would be made from the negative? A. That depends of course on the demand for a given picture; perhaps one hundred, two hundred.

1354 *William C. Ballard, Jr.—For Plaintiff—Recalled—Rebuttal—Cross.*

XQ416. It might be two hundred or more? A. Yes.

XQ417. And in making these two hundred or more positives you would have to use the two pasted together negatives of Fig. 1 of the patent? A. Yes.

Mr. Ward: You are assuming in that question that alternative form is going to
1355 be used where they are pasted together?
Mr. Ashton: Yes.

XQ418. You also stated that the lengths of a take might be very short, maybe one hundred feet. You are familiar with the statement of defendant in this case in which they stated that the film is developed in one continuous strip, are you not? A. Yes.

XQ419. And that might be many thousands of feet? A. It is of course possible to obtain a film of any given length by taking and connecting to-
1356 gether a large number of short pieces. Yes; of course, that is true.

XQ420. And that is the practice of defendant, is it not? A. I so understand by some stipulalation. It is a statement, it isn't a stipulation.

XQ421. You find disclosed in the Craig patent, do you not, the recording of sound and pictures on separate films? A. In the negative process, recording of sound negatives and picture negatives on separate film, yes.

XQ422. And you also find in that process that these two negative films developed separately are printed on one film? A. On the opposite sides of a single film.

1357

XQ423. On one film? A. Obviously it must be one film, if it is the opposite sides of it.

XQ424. And in Fig. 8 of the Craig patent there are two records side by side on the same film, are they not? A. I understand these to be two sound records of the same character, made according to the infra-red ray process.

XQ425. There are two records on that film, are there not? A. Two sound records.

XQ426. And does not Craig say that there may be more than two? A. I am not sure of that; I cannot answer the question without having read through the entire specification. Perhaps you can refer me to where that is stated. (Examining patent.) I believe that is a true statement, more than two sound records on one side of the film, yes.

1358

XQ427. You haven't ever heard of the Gaumont process which Mr. Jones mentioned in his testimony in which certain infra red or X-rays are used in a process such as is proposed by Craig?

1359

Mr. Ward: I object to that as an incorrect statement of Mr. Jones' testimony. He did not say anything about infra red rays being used.

XQ428. The process as described by Mr. Jones, Professor Ballard? A. I have no knowledge of it other than the published description in the British publication.

XQ430. It might have been used for all you know? A. There is no indication in the British

1360 publication that it was used, and I might point out at this time this is not a thing which involves the use of infra red rays, as does the Craig patent.

XQ431. I will ask you to refer to the Reimer patent. Reimer discloses, does he not, two separate records, one sound and pictures? A. Yes, he discloses a photographic recording and phonographic record.

1361 XQ432. And he combines both of these onto one medium, does he not? A. I do not take it that he does propose to do so. The system, as I understand it, is merely the pasting or the joining of the two together. They are not combined in the sense that they appear on the same homogeneous medium.

XQ433. Does not the claim of the patent state: "Process for making of a film which consists of an image band and a sound band having the distinctive feature that each band is made as an individual band separately and that both bands
1362 are thereupon combined with each other"? A. That is a correct statement. By combined, as explained in the specification, I understand that the two are joined together by any means *per se.*

XQ434. They are combined to make a single record, are they not? A. Two separate records cemented together, yes.

XQ435. When you are all through, you have a single record, have you not? A. I would not say that was a single record, no.

Re-direct Examination by Mr. Ward:

RDQ436. Is there anything in this British Gaumont article that Mr. Ashton asked you about

which suggested to you or suggests that Gaumont process had ever been used? A. There is nothing in the article, as I remember it, which would suggest that it was commercially feasible or had ever been used.

Mr. Ward: I offer in evidence certified copy of Vogt, *et al.*, German application as filed, No. V-16634, IX, 57a-2 filed April 2, 1919, as Plaintiff's Exhibit 32. 1364

(Marked Plaintiff's Exhibit 32 in evidence.)

Mr. Ward: With a translation, and the understanding is that the translation is accepted, subject to error, if any be found.

Mr. Neave: Yes.

Mr. Ward: It is agreed that these applicants of the German application, Joseph Massolle, Joseph Engl and Hans Vogt, are the same three applicants as in the other application in those names, and that they are each citizens of Germany and 1365 were at that time.

I offer in evidence certified copy of file wrapper and contents of Vogt, *et al.*, now abandoned, U. S. Application Serial No. 458,636, filed April 4, 1921, as Plaintiff's Exhibit 33.

(Received and marked Plaintiff's Exhibit 33 in evidence.)

Mr. Ward: I would like to offer in evidence a certified copy of decision of the State Superior Court, I of Berlin, in the case of Tonbild vs. Klang-film regarding

1366 *Case.*

Vogt, *et al.*, Germany patent 368,383, also a translation of that decision. That is a decision involving, as I understand it, a motion for permanent injunction brought in Germany under the German patent corresponding to the one in suit.

Mr. Neave: I object to that. It has no relevancy to this case. If that goes in, we will have to get in a whole lot more papers explaining that.

1367 As I understand it, in Germany, that a patent is valid if it had not been attacked a certain length of time, and not having been attacked a certain length of time, they get a preliminary injunction I object to that as not having any purpose in here.

Mr. Ward: This decision construes the British Bullis patent, and I think it has a great deal more relevancy than Mr. Neave's British File Wrapper and contents of a British patent.

The Court: If you are going to put that
1368 in, you have to put in the law which is not controlling, at any rate. I think I wrote on that, that it was not controlling, but that the decisions of foreign courts were entitled to respectful consideration. But that is only true when the law is put in evidence at the same time, because the law is quite different with reference to French and to German patents and to British patents, even, than the United States.

If it goes in, then they must be allowed to put in the law to show me what Germany does.

Mr. Ward: I have no objection to that.

1369

The Court: They have a right to show foreign litigations. They are not controlling, but they will receive respectful consideration if you want to put it in and put in the law, I will let you, because I think I am bound to consider it.

Mr. Neave: I cannot make any statement now because a lot of other papers would have to go in with it.

Mr. Ward: I am perfectly frank to state that it is my understanding that after a 1370
five-year period over there, the validity of the patent cannot be assailed. I am willing to stipulate with my opponent that that is the fact, and I merely want this decision to go in to show that *non constat* how the Court there considered the Bullis patent with respect to this disclosure in this German patent. I am not putting it up for any other purpose.

Mr. Neave: I agree with Mr. Ward's statement on that branch of the law. But here, just taking one paper out of a whole 1371
case, does not mean anything. If he has got the whole record, that will help it along.

Mr. Ward: We were precluded from getting the record because his Western Electric people are in control of the situation. I ask the Court to take this decree for what it is worth.

The Court: What have you here?

Mr. Ward: I have a decision of the Court. In a certified form.

The Court: That is, just the decision, not the papers on which it is based?

1372 *Case.*

Mr. Ward: It recites the situation very fully, and I am also prepared to hand up all the papers referred to in the decision. I have them here.

Mr. Neave: The Bullis patent you are talking about is not this American patent you have here?

Mr. Ward: The corresponding British Bullis patent. Will your Honor take this decree for what it is worth?

1373 The Court: Is the law conceded on that?

Mr. Neave: On that one point.

The Court: I will let him put it in and give you a chance to meet it, whatever time you want.

(Recision marked Plaintiff's Exhibit 34 in evidence.)

Mr. Ward: I also offer in evidence photostat of article of H. B. Marvin, of the General Electric Company in Transactions of S. M. P. E. for April, 1928, referred to in said German court decision.

1374 Mr. Neave: Same objection.

The Court: But it is not certified.

Mr. Ward: We have a stipulation covering that situation.

Mr. Neave: All right. That stipulation seem sto be broad enough to cover it.

(Marked Plaintiff's Exhibit 35 in evidence.)

Mr. Ward: Also photostatic copy of British patent to Bullis, No. 105,589, referred to in said decision.

(Marked Plaintiff's Exhibit 36 in evidence.)

Mr. Ward: I also offer in evidence as

Case.

Plaintiff's Exhibit 37, a series of letters between Mr. Schroeder and the American Telephone & Telegraph Company— 1375

Mr. Neave: State who Schroeder was.

Mr. Ward: Schroeder was the American representative at that time of the Tri-Ergon, A. G., of Zurich; and letters from my then firm to Mr. L. F. Morehouse, Department of Development and Research of the American Telephone & Telegraph Company, which were signed by Mr. Dyer 1376
Smith, then a member of the firm, letters from the American Telephone & Telegraph Company having been signed by Mr. Morehouse, the letters extending over a period from about September 8, 1925, to about August 4, 1926. And in connection with it, I call the Court's attention to paragraph 5-A of the letter from Ward, Crosby & Smith to Mr. Morehouse, dated October 29, 1925, which mentions the German patent corresponding to the application of the patent in suit under Item 5-A on page 2. 1377

(Marked Plaintiff's Exhibit 37 in evidence.)

Mr. Ward: I offer in evidence as Plaintiff's Exhibit 38 the article in the American Cinematographer as sent by the Schroeder letter of September 8, 1925, to the American Telephone & Telegraph Company.

(Marked Plaintiff's Exhibit 38 in evidence.)

Mr. Ward: Is it agreeable to you to stipulate that the American Telephone &

1378 Telegraph Company is the parent company of the Western Electric Company?

Mr. Neave: A. T. & T. owns nearly all the Western Electric stock and the Western Electric Company owns Electrical Research Products.

Mr. Ward: And the Bell Laboratories is also a subsidiary of the American Telephone & Telegraph?

Mr. Neave: Half a subsidiary of the
1379 A. T. & T. and half a subsidiary of Western.

Mr. Ward: I would like to ask Mr. Neave if he is willing to stipulate that the decision in this suit will be *res adjudicata* as against the Western Electric and its affiliates?

Mr. Neave: I could not see that any stipulation on my part would change the situation. As a matter of record here, the record shows that the Electrical Research Products is defending this suit, so that
1380 your decree goes as far as your record goes.

Mr. Ward: I have had some experience in these things, and I would like to know if you will agree to stipulate that the Western Electric and its affiliates may be subject to the process of this court, and injunction of this court.

Mr. Neave: I will stipulate nothing about that. If you want any more facts on the record, you can have them. I think you have got all the facts.

Mr. Ward: That will cut both ways,

1381

your Honor. He declines to have the Western Electric family abide by the decision of the court, except insofar as the decision of the court may control in view of the fact that they defend.

Mr. Neave: I offer in evidence the original of page of the publication of Film Kurier of February 6, 1932, together with a translation, this being an article by Hans Vogt, one of the applicants for the patent in suit.

1382

Mr. Ward: I object to this as wholly irrelevant and immaterial. As I pointed out here before this man is no longer in our employ or control.

The Court: He was one of the applicants.

Mr. Ward: And I understand that he is somewhat under the control of our opponents here now, and as I understand it, this article is the article that Mr. Neave referred to where this man says that he invented the whole thing. It is a self-serving declaration by the defendant's interests and has no relevancy at all.

1383

The Court: I will take it.

(Marked Defendant's Exhibit R in evidence.)

ORDER.

The record in this case having been left open for the purpose of permitting defendant to introduce evidence in connection with the decision

1384 *Case.*

of the State Superior Court I of Berlin in the case of *Tonbild-Syndikat Aktien-Ges.* vs. *Klangfilm G. m. b. H.*, Plaintiff's Exhibit No. 34, it is, upon the attached stipulation, Ordered,

1. That the certified record in the said suit and the translation thereof, heretofore submitted to plaintiff's counsel, may be received in evidence and shall be marked by the Clerk as Defendant's Exhibit S.

1385 2. That the reporter of this Court is hereby instructed to add to the transcript of the record herein a copy of this order and a copy of the stipulation of the parties annexed hereto.

Dated, January 10, 1933.

(Signed) MARCUS B. CAMPBELL,
United States District Judge.

STIPULATION.

1386 It is stipulated by and between the parties hereto, for the purposes of this suit only, as follows:

1. That under the provisions of the German Patent Law the validity of a German patent cannot be attacked in a patent infringement suit. This stipulation shall not estop plaintiff from arguing that the scope of a German patent can be adjudicated or determined in a patent infringement suit.

2. That under the provisions of the German Patent Law the validity of a German patent can

1387

only be attacked by nullity proceedings instituted in the German Patent Office.

3. That no nullity proceedings were ever filed against German patent No. 368,383.

4. That under the provisions of Section 28, paragraph 3 of the German Patent Law no nullity proceedings attacking the validity of a patent can be instituted after the expiration of five years from the date of publication (Ausgegeben date) of the patent.

1388

5. That the period during which nullity proceedings could have been instituted against German patent No. 368,383, Defendant's Exhibit L, expired on February 2, 1928, which is prior to the commencement on February 6, 1928, of the suit of *Tonbild-Syndikat Aktien-Ges.* vs. *Klangfilm G. m. b. H.*, which suit is further identified in Plaintiff's Exhibit 34 and Defendant's Exhibit S herein.

6. That the preliminary injunction in the said suit of *Tonbild-Syndikat Aktien Ges.* vs. *Klangfilm G. m. b. H.*, above referred to was granted under Sections 936 and following sections of the German Code of Civil Procedure without the defendant having been heard, but that as to the motion to modify said preliminary injunction (the decision upon which motion is Plaintiff's Exhibit 34) counsel for both sides filed papers and made oral arguments at the hearing.

1389

(Signed) S. Mortimer Ward, Jr.,
Counsel for Plaintiff.

(Signed) Henry R. Ashton,
Counsel for Defendant.

1390 *Case.*

ORDER.

Upon the attached stipulation it is Ordered:

That said stipulation be made a part of the record in this case, and the reporter of this Court is hereby instructed to add to the transcript of the record herein a copy of this Order and a copy of the annexed stipulation.

(Signed) MARCUS B. CAMPBELL,
1391 United States District Judge.

January 10, 1933.

STIPULATION.

IT IS STIPULATED by and between the parties hereto, for the purposes of this suit only, as follows:

1392 1. That the applicants for the following applications are the same: (a) German application V.14634 IX/57a2, filed April 2, 1919 (Plaintiff's Exh. 32); (b) United States application Ser. No. 458,636, filed April 4, 1921 (Plaintiff's Exh. 33); (c) Application for French Patent No. 532,750 ((Defendant's Exh. H); (d) German application V.16431 VI 57a2 (Plaintiff's Exh. 6); (e) United States application Ser. No. 547,860, filed March 29, 1922, for the patent in suit (contained in Plaintiff's Exh. 3).

2. That prior to 1919, Germany was and ever since has been a "Convention" country with re-

1393

spect to R. S. 4887, and its citizens since prior to 1919 have been entitled to the privileges of said statute.

3. That all of the privileges accorded by the Nolan Act of March 3, 1921 (41 St. L. 1313) were extended to citizens of Germany; and that this stipulation be made a part of the record in this case.

(Signed) WARD, CROSBY & NEAL,
Solicitors for Plaintiff.

1394

(Signed) HENRY R. ASHTON,
Counsel for Defendant.

Dated, December 29, 1932.

1395

1396 **Stipulation and Order Approving Condensed Statement of the Testimony.**

UNITED STATES DISTRICT COURT,

EASTERN DISTRICT OF NEW YORK.

AMERICAN TRI-ERGEN CORPORATION,
Plaintiff-Appellant,
vs.
1397 PARAMOUNT PUBLIX CORPORATION,
Defendant-Appellee.

Upon the annexed consent of the parties hereto, it is

Ordered that the foregoing condensed statement of the testimony, taken at the trial, is hereby approved as a true, complete and properly prepared statement of the evidence herein, to be included in the record on appeal, in accordance
1398 with Equity Rule 75.

MARCUS B. CAMPBELL,
United States District Judge.

Dated, February 13, 1934.

Consent to the entry of the foregoing order is hereby given.

Dated, January 27, 1934.

WARD, CROSBY & NEAL,
Attorneys for Appellant.
HENRY R. ASHTON,
Attorney for Appellee.